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Effect of fungicides on seed quality of lentil (*Lens culinaris* L.) during storage

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Abstract

Laboratory tests were carried out to study the effect of different fungicides i.e. Bavistin DF, Vitavax and Genuine 50WP on the seed quality of lentil during storage condition. After processing and drying, seeds were preserved separately with three fungicides at the rate of 2.5g kg^{-1} of seeds and stored in earthen pots till next planting time. The seed quality i.e. moisture content (%), germination rate (%), dry weight (g) of seedlings and vigour index were measured at the end of storage period. The average germination percentage of the initial seed lot was 90% and moisture content was 9%. Among the three fungicides, Bavistin DF showed higher values for germination percentage (91.3% in 2004 and 92.7% in 2005), dry weight (0.70 g in 2004 and 0.67 g in 2005) and vigour (63.8 in 2004 and 62.1 in 2005).

Key words: Lentil, fungicides, storage, seed quality.

INTRODUCTION

Lentil is one of the important pulse crops grown in Bangladesh that supplement the everyday needs for protein, essential minerals and vitamins. It is the second most important pulse crop in respect of area and production**,** but stands first in the consumer's preference in this country (Afzal *et al.*, 2003) and contributes about 45% to the total pulses production (BBS, 2014).

Poor seed quality leads to low germination rate, low vigour, poor growth and high incidence of seed-borne diseases all of which appear to be managerial rather than technological problems. Suitable control measures for pests and diseases, both in the field and storage condition may optimize the seed quality. Fungicidal treatment of seeds is followed in maintaining seed viability in storage condition (Khatun, 2007; Khatun *et al*., 2010; Khatun *et al.,* 2011). Information regarding storage conditions with fungicides is almost scarce in Bangladesh, which are pre-requisite for promotion of lentil cultivation (Khatun, 2007; Khatun *et al*., 2011).

In Bangladesh, almost every individual farmer keeps a portion of their quality seeds for future use and is aware of its importance. But proper care is not maintained in the storage condition. As a result, seeds kept by the farmer, which have not received due care at the

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time of its production, preservation and utilization; do not give satisfactory results in the long run. Most of these seeds turned to inferior in quality, become infested with pests and diseases along with poor purity and low percentage of germination. This state of affairs had been continuing since long and this is one of the most important reasons of low agricultural production in the country (Ahmed, 1965).

In storage, lentil seeds deteriorate in its quality due to fungal, insect or other pest infestation. Different fungicides are used for protection of seeds. Uses of different chemicals are costly and may cause natural hazard. Comparative studies of synthetic/chemical fungicides help to choose the suitable one for storing the seeds of lentil. Carbendazim is a widely used, broad-spectrum benzimidazole fungicide that sold with the trade names Bavistin DF, Genuine 50WP, Forastin WP etc. While Carboxin is a chemical compound from the group of Oxathiins and Carboxamides sold with the trade names Vitavax, Cadan, Vegetox etc. Bavistin DF and Genuine WP from Carbendazim group and Vitavax from Carboxin group were chosen in the present experiment due to their popularity at the farmers' level and availability in the pesticide markets. Thus, the experiment was carried out to determine the effects of three fungicides viz. Bavistin DF, Vitavax and Genuine 50WP on the seed quality of lentil in storage condition.

MATERIALS AND METHODS

Experiments were conducted during August-September 2004 and 2005 at the Laboratory of Seed Technology Division, Bangladesh Agricultural Research Institute (BARI), Gazipur. The seeds of lentil were collected from Pulses Research Centre, Bangladesh Agricultural Research Institute (BARI), Gazipur. Clean and fresh lentil (BARI Masur-2) seeds were taken from the seed lot and sun dried to maintain 9-10% moisture content. Before setting up the experiments, the grains were taken in earthen pots (1 kg size) and stored at room temperature for future use. The prepared seeds were then divided into four parts. One part was considered as control (T_4) i.e. without any chemical treatment. Other three parts were treated with three different fungicides such as Bavistin DF, Vitavax and Genuine 50WP were used at the rate of 2.5 g kg^{-1}. Experiments were laid statistically following CRD with six replications. Before storage, seeds were analyzed for germination, moisture content and vigour index. The seeds were stored till next planting time and seed quality data on moisture content (%), germination rate (%) and vigour index were recorded.

Moisture content: The moisture content of seed samples were determined following ISTA rule of 1976. Ground seed samples (10g) were taken into a moisture cup and put into a pre-heated oven at temperature of 103 ± 2^{o}C for one hour. After cooling, the weight of the container with its cover and contents were taken. The samples were cooled in desiccators and weighed to find out the percent moisture content of the grains. The seed moisture content was determined by dry weight basis and was calculated by the following formula:

$\{(M_2-M_3) / (M_2-M_1)\} \times 100$

Where, M_1 is the weight (g) of the container including its cover,

M_2 is the weight (g) of the container, its cover and its contents before drying, and

M_3 is the weight (g) of the container, its cover and contents after drying.

Germination test: Germination percentage of the initial seed lot was on average 90%. Germination test was carried out according to ISTA rule of 1976. For each treatment, 100 seeds were put into petri dishes having water soaked blotting paper at the bottom. Six replicates were used. The petri dishes were put on a laboratory table at room temperature (25 ± 2^oC). After ten days, germinated and ungerminated seeds were inspected and counted.

Dry weight of seedling: To determine the fresh weight, the root and shoot of the seedling from each treatment were put into paper packet separately and placed into the preheated oven (70^oC) for 48 hours. After cooling in desiccators, the dry weight was measured.

Seed vigour: Seedling vigour was calculated based on the following formula (Reddy and Khan, 2001):

Vigour index= Percent germination × total dry weight of seedling.

Statistical analysis: The data for different characters were compiled and subjected to statistical analysis following a computer IRRISTAT and MSTAT software (Freed, 1992). The correlation co-efficient and regression analysis were carried out for different variables wherever needed using Microsoft Excel Programme 1997.

RESULTS AND DISCUSSION

Moisture content: Moisture content was statistically significant only in 2004 and non-significant in 2005 (Table 1). The highest moisture content recorded were 9.98% in 2004 and 9.90% in 2005 observed in lentil seeds when received control treatment. The lowest moisture content, 8.91% in 2004 and 8.60% in 2005 were observed in Bavistin DF treated seeds. Shahjahan (2003) observed that lentil seeds contained 8.57-11.45% moisture content after nine months of storing in six types of containers. Khatun *et al*. (2008) reported that moisture content of lentil seeds of BARI Masur-2 ranged from 8.19 to 10.36%.

Germination percentage: Effect of three fungicides on germination percentage was found significant (Table 1). Maximum germination rate 91.3% in 2004 and 92.7% in 2005) were recorded when the seeds preserved in Bavistin DF while the lowest germination rate 74.7% in 2004 and 79.3% in 2005 were observed in control treatment. Seeds preserved in Bavistin DF were identical for germination percentage to Vitavax and Genuine 50WP in only 2004. Shahjahan (2003) recorded 87.8-92.9% germination of lentil seeds after nine months of storing. Savitri *et al*. (1994) found that different fungicides (Thiram, Mancozeb, Carbendazim and TCMTB) showed higher germination

percentage (64.9-69%) compared to the control (61.3%). Germination was fund lowest in the untreated seed but the combination of Captan + Benzene hexachloride (B.S.C) was able to maintain better quality than the control (Paul *et al*., 1992). Grewal and Kapoor (1966) reported that treatment with fungicide prolongs the viability of seeds. Begum (1998) reported that over 90% control of seed-borne infection and significant increase in germination of higher number of healthy seedlings by treating mungbean seeds with 0.3% of the four fungicides viz. Vitavax, Bavistin DF, Knowin and Dithane M-45. The best results were obtained with Bavistain DF (Carbendazim), followed by Thiram and Dithane M-45 (Mancozeb). Khatun *et al*. (2008) found 84.3 to 94.2% germination in lentil when seeds were stored under normal storage condition.

Table 1. Effects of different fungicides on seeds quality parameters of lentil under laboratory storage condition

Fungicides	Moisture content		Germination percentage		Dry weight (g)		Vigour index	
	2004	2005	2004	2005	2004	2005	2004	2005
Bavistin	8.91b	8.60	91.3a	92.7a	0.70a	0.67	63.8a	62.1a
Vitavax	8.98b	8.98	84.3ab	85.3b	0.60b	0.63	51.1b	58.9a
Genuin	8.98b	9.20	80.5ab	84.7b	0.66ab	0.67	51.7b	56.5ab
Control	9.98a	9.90	74.7b	79.3b	0.57b	0.58	44.7b	46.0b
SE (±)	0.32	-	5.10	2.99	0.04	-	4.59	4.94
LSD(0.05)	0.68	NS	10.9	8.8	0.09	NS	13.5	10.5
CV (%)	6.0	10.2	10.7	6.1	12.0	14.1	15.1	15.3

In a column means followed by common letters do not differ significantly at 5% level by DMRT.
NS: Not significant

Dry weight of seedlings: Dry weight of lentil seedling was found statistically significant during 2004 and non-significant in 2005 (Table 1). Maximum dry weight of seedling 0.70 g in 2004 and 0.67 g in 2005 was recorded when the seeds were treated in Bavistin DF. Seeds treated in Genuine in 2004 also showed similar results. Minimum dry weight of seedling 0.57 g in 2004 and 0.58 g in 2005 were observed in control treatment. Khaun *et al*. (2009a) observed that dry weight of seedlings of lentil was found between 0.75 to 1.21 g under normal storage condition.

Vigour index: The effect of fungicides on vigour index was found significant. Maximum values of vigour index were 63.8 in 2004 and 62.1 in 2005 recorded from Bavistin DF treated seeds while the lowest vigour index 44.7 in 2004 and 46.0 in 2005 were observed in control treatment (Table 1). Fungicides inhibited fungal growth and improved seedling vigour (Zote and Mayee, 1982). Khatun *et al*. (2009a) reported 70.3 to 120.2 vigour index in lentil. In another study, Khatun *et al*. (2009b) also observed 71.2 to 97.1 vigour in lentil variety BARI Masur-2.

Correlation: Correlation matrix among the plant characters of lentil has been shown in Table 2. A positive and significant correlation was observed between germination percentage and vigour index (2004), dry weight and vigour index (2004 and 2005).

A positive and linear correlation was observed between germination percentage and dry weight, germination percentage and vigour index and also dry weight and vigour. But negative and linear correlation was observed between moisture percentage and germination percentage. Positive and linear correlation observed for germination percentage with dry weight, germination percentage and vigour index, and dry weight and vigour index of lentil were directly related to germination percentage. Reddy and Khan (2001) found a positive and significant correlation of germination with seedling dry weight and vigour index. Baburatan *et al*. (1993) and Ponnuswamy *et al*. (1991) reported similar results. Khatun *et al*. (2009a and 2009b) also observed positive and significant correlation of germination with dry weight and vigour, and dry weight with vigour.

Table 2. Correlation matrix among different parameters of lentil

Characters	Correlation coefficient (r value)					
	Germination (%)		Dry weight		Vigour index	
	2004	2005	2004	2005	2004	2005
Moisture (%)	-0.137^{ns}	-0.274^{ns}	-0.269^{ns}	-0.192^{ns}	-0.345^{ns}	-0.337^{ns}
Germination (%)	-	-	0.368^{ns}	0.134^{ns}	0.704^{**}	0.356^{ns}
Dry weight	-	-	-	-	0.785^{**}	0.743^{**}

** Significant at 1% level, NS: Not significant

From the result, it was observed that seeds preserved with Bavistin DF had higher germination percentage, dry weight and vigour index compared to Genuine 50WP and Vitavax.

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