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Growth and Yield of Wheat in Response to Different Seed Storage Conditions

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Abstract: An experiment was conducted at Agronomy field, Sher-e-Bangla Agricultural University, Bangladesh from November, 2011 to March 2012 to investigate the response of different seed storage conditions on production of BARI Gom-24. Four different seed storage conditions viz. C_1: below 10°C; C_2= below 20°C; C_3= Polybag (room temperature) and C_4=Tin container (room temperature) were used on experiment following Randomized Complete Block Design with three replications. The maximum plant height (95.9 cm at harvest), number of tillers (4.5/m^2 at harvest), dry weight (81.0 g at harvest), spike length (17.5 cm), number of grains (41.5/spike), filled grains (39.9/spike), 1000-grains weight (43.3 g), grain yield (3.6 t/ha), straw yield (5.6 t/ha) and biological yield (9.2 t/ha) was found from C_1 which was statistically identical with C_2 whereas, the minimum from C_4. The seed storage conditions can be ranked from best to worst as below 10°C > below 20°C > Polybag (room temperature) > Tin container (room temperature). Seeds storing at tin container (room temperature) were poor in the view of yield.

Key words: *Triticum aestivum* · Seed storage conditions · Growth and yield

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the second most important food crop in Bangladesh and about two third of the total world's population consume it as staple food [1]. Seed health is an important attribute of quality and seed used for planting should be free from pest. Seed infection may lead to low germination, reduced field establishment, severe yield loss or a total crop failure. For example, severely infected wheat grains with kernel bunt either fail to germinate or produce a greater percentage of abnormal seedlings [2]. In most cases seed health deteriorate due to poor storage conditions of seed. Due to poor storage conditions seed may be easily affected by stored grain insect or seed borne pathogen. Moreover, Seed deterioration associated with loss of viability during storage results in decreased early growth of roots and shoots and in increased variability of growth between plants. This early inhibition of growth-rate does not persist and there is some evidence that under normal agricultural conditions, initial low rates of growth may be compensated at later stages of development. Providing appropriate storage condition with optimum temperature seed health may be more or less ensured. Crop production could be increased by suitable seed storage condition with providing optimum temperature. Considering the above fact, the study was conducted to judge the effect of different storage conditions with the objectives to study the importance of ideal seed storage condition.

MATERIALS AND METHODS

The present study was carried out to investigate the response of different seed storage conditions on the production of BARI Gom-24 during November, 2011 to March 2012 at Agronomy field, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh. Seeds were collected from Bangladesh Agricultural Development Corporation (BADC) and four different seed storage conditions viz. C_1: below 10°C; C_2= below 20°C;

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C_3= Polybag (room temperature) and C_4=Tin container (room temperature) was used on experiment following Randomized Complete Block Design with three replications. The unit plot area was 4m × 2.5m, plot to plot and block to block distances were 0.5m and 1.0 m, respectively. Moisture status and Germination percentage of seeds were recorded in every month from July to November, 2011.

Fertilizers were applied at the rate of 100, 80, 30 and 20 kg ha^{-1} of N, P, K and S respectively and 5 t ha^{-1} cowdung. The 2/3rd urea and whole amount of other fertilizers were applied as basal dose and rest 1/3rd urea was applied at crown root initiation stage (21DAS) followed by an irrigation. Seeds were treated (with Provex 200 @ 3 g kg^{-1}) of seeds before sowing @ 125 kg ha^{-1} and were placed in 20 cm apart lines.

Data were collected from 10 randomly selected wheat plants from each plot. Crop of each plot was harvested from $4m^2$ areas leaving the border lines to record the seed yield which was converted into t ha^{-1}. Data were collected on plant height, number of tillers (linear), dry weight $plant^{-1}$, spike length, number of spikelets $spike^{-1}$, number of filled grains $spike^{-1}$, 1000-grain weight, grain yield, straw yield, biological yield and harvest index. The plants with roots were collected at different days after sowing from each plot and then oven dried at 70° C for 72 hours. The dried samples were then weighed and averaged. Dry weight was taken from 10 plants collected from inner rows of each plot. Thousand seeds were counted from seed sample and weighed at about 12% moisture level using an electric balance. After threshing, proper drying (12% moisture level) and cleaning, yield of each sample plot was recorded and values were converted to t ha^{-1}. Biological yield was determined by addition of grain yield and straw yield. Harvest index was determined by dividing the grain yield by total biological yield (grain yield + straw yield) and multiplying by 100 [3].

Collected data were statistically analyzed by MSTAT–C software computer package program and mean differences were evaluated by Duncan's Multiple Range Test (DMRT) at 5% level of probability [4].

RESULTS

Plant Height: Plant height of wheat showed a significant variation among different seed storage conditions at different days after sowing. However, the tallest plant was found from C_1 (95.5 cm) which was statistically identical with C_2 (91.1 cm), while the shortest from C_4 (85.6 cm) at harvest (Fig. 1a).

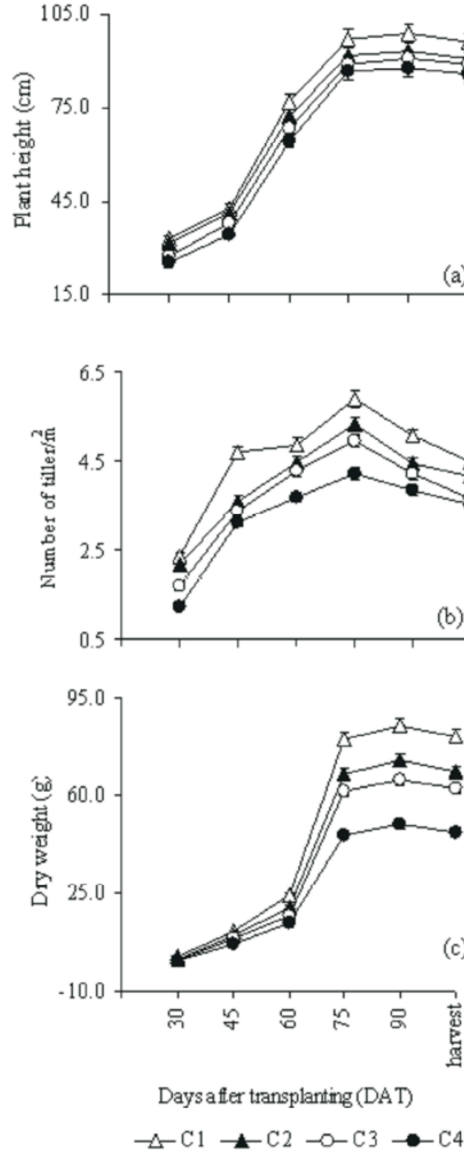

Fig. 1: Response of wheat to different seed sources on (a) plant height, (b) number of tillers and (c) dry weight

Number of Tillers: Significant variation was found on number of tillers from different seed storage conditions at different days after sowing. The maximum number of tillers was found from C_1 (4.5/plant), whereas the minimum from C_4 (3.5/plant) at harvest (Fig. 1b).

Dry weight: Significant variation was found on dry weight from different seed storage conditions at different days after sowing. The maximum dry weight was found from C_1 (81.0 g/plant), whereas the minimum from C_4 (46.9 g/plant) at harvest (Fig. 1c).

Table 1: Moisture and Germination percentage of at the end of storage (November)

Storage Conditions	Seed moisture (%)	Seed germination (%)
Below 10° C	9.1	88.0
Below 20° C	10.2	86.0
Polybag	10.3	78.0
Tin container	10.1	76.0

Table 2: Responses of wheat to different seed storage conditions on yield related attributes and yield[x]

Seed storage conditions	Spike length (cm)		Grains /spike		Filled grains /spike		1000-grains weight (g)		Yield (t/ha) grain		straw		biological		Harvest index	
C_1	17.5	a	41.5	a	39.9	a	43.3	a	3.6	a	5.6	a	9.2	a	39.2	a
C_2	16.9	a	41.2	a	39.3	a	41.6	ab	3.3	ab	5.4	ab	8.7	ab	38.2	a
C_3	16.6	a	39.7	b	37.7	ab	40.2	bc	3.2	b	5.0	bc	8.2	b	39.3	a
C_4	16.4	a	38.1	c	36.4	b	38.6	c	2.8	c	4.4	c	7.3	c	39.3	a
LSD 0.05	2.2		1.3		2.5		2.6		0.3		0.6		5.7		4.5	
CV%	1.2		1.7		3.3		3.2		5.2		5.4		3.4		5.7	

[X] In a column mean values having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of significance

Spike Length: Statistically similar result was found for spike length at different seed storage conditions. However, the maximum spike length was found from C_1 (17.5 cm), whereas the minimum from C_4 (16.4 cm) (Table 2).

Number of Grains: Number of grains of wheat was varied significantly due to the variation of seed storage conditions. The maximum number of grains was found from C_1 (41.5/spike) which was statistically identical with C_2 (41.2/spike) followed by C_3 (39.7/spike), while the minimum from C_4 (38.1/spike) (Table 2).

Number of Filled Grains: Number of filled grains of wheat showed significant variation among different seed storage conditions. The maximum filled grains was found from C_1 (39.9/spike) which was statistically identical with C_2 (39.3/spike) followed by C_3 (37.7/spike), while the minimum from C_4 (36.4/spike) (Table 2).

1000-Grain Weight: Significant variation was observed on 1000-grain weight of wheat among the different seed storage conditions. The maximum 1000-grain weight was found from C_1 (43.3 g) which was statistically identical with C_2 (41.6 g) followed by C_3 (40.2 g), while the minimum from C_4 (38.6 g) (Table 2).

Grain Yield: Significant variation was observed on grain yield of wheat among different seed storage conditions. The maximum grain yield was found from C_1 (3.6 t/ha) which was statistically identical with C_2 (3.3 t/ha), whereas the minimum from C_4 (2.8 t/ha) (Table 2).

Straw Yield: Significant variation was observed on straw yield of wheat among different seed storage conditions. The maximum straw yield was found from C_1 (5.6 t/ha) which was statistically identical with C_2 (5.4 t/ha), while the minimum from C_4 (4.4 t/ha) (Table 2).

Biological Yield: Significant variation was observed on biological yield of wheat among different seed storage conditions. The maximum biological yield was found from C_1 (9.2 t/ha) which was statistically identical with C_2 (8.7 t/ha), whereas the minimum from C_4 (7.3 t/ha) (Table 2).

Harvest index: Statistically similar results were found from different seed storage conditions for harvest index. The maximum harvest index was found from C_3 and C_4 (39.3%) followed by C_1 (39.2%), while the minimum from C_4 (38.2%) (Table 2).

DISCUSSION

Seed quality and longevity of seeds during preservation period mainly depends on two major factors: biotic factors like insects, fungi, bacteria, virus, rodents, etc. and abiotic factors like temperature, relative humidity, moisture content, rainfall, day length and sunshine, etc. Due to high nutritive value, seeds are prime target of attack of various microorganisms and insects. Among microorganisms fungi play a dominant role in infecting quality and longevity of seeds in storage [5]. Previously it was also studied to store seed at different conditions and containers. Tin container is the best means for cucumber seed storage tin container, poiy bag and cloth bag [6] which showed the resemblance of the current study. Verma *et al.* [7] examined the seed lots of *Brassica juncea* and *B. campestris* stored under ambient conditions of temperature and humidity and concluded that the seed seeds are varied from one lot to another due to the variation of the storage conditions. In general, prevalence of fungi was found lower in the seedling stored in polythene bag followed by the seeds of metal container and cloth bag. Among all the fungi was highest in prevalence in the seedlings of cloth bag followed by metallic container and in polythene bag. Value was lowest in metal container and polythene bag due to lower seed moisture of the seed [8]. In this study wheat seed stored at below 10°C temperature provided the less moisture content on the seed than the others and for this result lowed amount of the disease and fungal attack happed in the crop field and provided best growth and yield. According to Justice and Bass [9] when in storage the moisture content of seed goes above 8-9% then the risk of insect, fungal and bacterial attack increases. Besides low temperature is not suitable for the fungal infection and seed bone diseases which was ultimately affect the growth and yield.

CONCLUSION AND RECOMMENDATIONS

Storage of seed at below 10°C and 20°C temperature showed better performance. So seed storing comparatively lower temperature provide better growth and yield of wheat. However, to reach a specific recommendation, more research work on wider range of seed storage condition effect on growth and yield of wheat should be done over different agro-ecological zones of the country.

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