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Comparative Evaluation of Different Packaging Materials for Barley Seed Quality over Various Storage Periods

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Abstract: The study was conducted during 2018 to 2020 on seeds of barley variety HB1307 at Holetta Agricultural research center seed laboratory to determine the effect of different packaging materials for barely seed quality over various storage periods. Five packaging materials and five storage periods were laid out in Completely Randomized Design with four replications. Results showed that moisture content, thousand seed weight, germination percentage, vigor index-I, vigor index-II, and felid emergence index were affected by packaging materials, storage months and their interaction. Both standard germination and speed of germination had rapidly declined for seeds stored in jute bag and polypropylene bag ater 18 and 24 months of storage while hermetic bags maintained good germination. Storage fungi genera such as *Ascochyta, Penicillium, Bipolaris, Alternaria, Aspergillus, Aspergillus, Rhizopus, Eppiccocum, Trichoderma, Fusarium, Botrytis, Cladosporium* and *Phoma* were detected in the seed samples. Relatively less diseases incidence was observed for seed stored in supper grain pro bag at all storage months as compared to other storage materials. In conclusion, as storage month's progress, barley seed quality deteriorates while packaging materials viz. polypropylene bag with polyethylene sheet lining, PICS bags and Super Grain Pro bag-maintained seed quality. Therefore, barley seed growers are advised to use such materials depending on their economic advantages.

Keywords: Barley, Packaging Materials, Storage Durations, Seed Quality

1. Introduction

One of the most important basic needs for higher agricultural production is quality seed that can be characterized by high viability and vigor. Maintenance of seed quality from the harvest till growing season is of the utmost importance in a seed production program. During seed storage, qualitative and quantitative losses up to 8.5% have been reported [1].

Storage of seeds till the next sowing season is an essential segment of seed industry. Seed deterioration begins immediately after physiological maturity and is reflected in terms of loss in viability and vigor. The viability and vigor largely depend on the genotypes, production, location, mechanical injury to the seed, initial seed quality, seed treatment, packaging material and storage conditions [2]. Packaging is essential for storage and distribution of any seed material in units of safe and convenient size. The most important function of seed storage is protection against climatic factors, mechanical and physical hazards during storage, transport and distribution [3]. The use of quality seed in cultivation is one of the most important factors that can increase farm level yield. Although seed quality is governed by genetic makeup, seed storage and retention of viability are important for seed vigor [4]. To maintain the quality of seeds during storage, the standardization of suitable seed treatment and packing material is most important because seed treatment is the basic measure to assure adequately healthy crops at emergence and during further growth of plants [5].

Poor seed quality may be due to poor storability, which is very often being decided by internal and external factors. Hermetic storage is among controlled atmosphere technologies to prolong grain shelf life. This nearly anaerobic environment kills insects and mites and prevents aerobic fungi from growing. However, there is limited information

on the effect of those technologies on seed physiological quality. Therefore, this experiment was conducted with the objective of determining the effects of different packaging materials for barley seed quality over various storage periods.

2. Materials and Methods

A seed of barley crop namely HB1307 variety was used at Holetta Agricultural research center during 2018 to 2020 G. C. A 30 kg homogenized pre-basic seed of barely crop produced in 2018 main cropping season were used for the experiment. For this experiment 5 x 5 factorial combination of completely randomized design in four replications was used. The factors considered were: five packaging materials (Jute bag, Polypropylene bag, Polypropylene bag with polyethylene sheet lining (Fertilizer bag), PICS bag and Grain Pro Super bag) and five storage months [0 (Initial/before packaging and storage), 6, 12, 18 and 24 months] at seed storage room of Holetta agricultural research center. Initial/ before packaging and storage data were taken as control and sample were recorded every six months for two years.

2.1. Data Collected Include

Moisture Content: Moisture content was determined by using the indirect moisture testing meter HE *light* following international rules for seed testing.

Thousand seed weight: was determine by using seed counter machine and weighing 1000 seeds by using Sensitive balance.

Standard germination test: Standard germination test was done by using Four hundred (400) seeds were randomly taken from mixed pure seed and divided in to four replicates of 100 seeds each. The seeds were sown in sterilized sand medium and kept in Seed germinator at room temperature. The first count was done on 5th day after planting for field pea, 4th day after planting for barely and final count was done on 8th day. Seedling was evaluated in to normal, abnormal. Seedling, Hard and dead seed. The standard germination was calculated in percentage [6]. (ISTA, 1996) as follow:

$$Germination(\%) = \frac{Total\ Number\ of\ normal\ Seeedling}{Total\ Number\ of\ Seeds\ Planted}\ X\ 100\%$$

Shoot and root length: The seedling shoot length and seedling root length were assessed after the final count in the standard germination test. Ten normal seedlings were randomly selected from each replicate. The shoot length was measured from the point of attachment to the cotyledon to the tip of the seedling. Similarly, the root length was measured from the point of attachment to the cotyledon to the tip of the root. The average shoot or root length was computed by dividing the total shoot or root lengths by the total number of normal seedlings measured [7].

Seedling dry weight: The seedling dry weight was measured after the final count in the standard germination test. Ten seedlings randomly selected from each replicate were cut free from their cotyledons and placed in envelopes and dried in an oven at 80 ± 1°C for 24 hours. The dried seedlings were weighed to the nearest milli-gram and the average seedling dry weight was calculated.

Vigor Index test: The seedling vigor index was calculated for each sample as per [8] and expressed in number by using formula below. Seedling vigor index 1 was calculated by multiplying the standard germination with the average sum of shoot length and root length after 8 days of germination and vigor index 2 was again calculated by multiplying the standard germination with mean seedling dry weight (drying at temperature of 80°C for 24 hours). The formula for these parameters:

SVI1 = Standard germination × mean seedling length (Roots +Shoots length);

SVI2 = Standard germination × mean seedling dry weight

Speed of germination: Speed of germination is also another indicator used for assessing the vigor of seeds. Speed of germination (GS) was calculated [9]. As follows:

$$SG = \frac{Number\ of\ Normal\ Seedlings + \cdots + Number\ of\ Normal\ Seedlings}{Days\ of\ First\ Count\ Days\ of\ Final\ Count}$$

Field Emergence Index: All treatments were sown in a pot experiment using well prepared soil for emergence. 4x100 seeds were planted from each variety. The emergence data were recorded daily until further emergence stopped. The field emergence index was calculated by dividing the number of seedlings emerged at each day with the number of days in which they were emerged [10].

$$EI = \frac{Number\ of\ Seedlings\ Emerged}{Days\ of\ First\ Count} + \ldots + \frac{Number\ of\ Seedling\ Emerged\ at\ Final\ Count}{Days\ of\ Final\ Count}$$

Seed health testing: Seed sample were studied for association of different fungal and bacterial seed- borne pathogen. The procedure for Isolation of seed borne bacteria and fungi was similar whereas the identification was different. Seed borne pathogens were tested by using agar plate method (for internal pathogens). The Seeds were treated with 1% sodium hypochlorite (NaOCl) solution for five minutes. fifty seeds were placed at equal distance on Petri-dishes which replicate four times and then incubated at a temperature of 25°C with alternating light and dark period of 12 hours for eight days and then slides were prepared in order to identify. Identification for seed borne fungi was based on morphological traits including colony features, structures, and spores using stereo- and compound-microscopes.

$$Seed\ infection(\%) = \frac{Number\ of\ infected\ seed}{Total\ number\ of\ seed} \times 100\%$$

2.2. Data Analysis

The data obtained from each treatment were analyzed using SAS version 9.3 mean comparisons among treatments were done using the Tukey's Studentized Range (HSD) test at 5% level of significance.

3. Result and Discussion

3.1. Moisture, Thousand Seed Weight, Standard Germination, and Speed of Germination

Analysis of variance result showed that there were significant (P<0.01) effects of packaging materials, storage period, and their interaction for moisture content and thousand seed weight of barely seed. The initial moisture content of barely seed was 13.0 % at the beginning of the storage experiment. There was a significant increase in moisture content of seeds stored in jute bag and polypropylene bags without polyethylene sheet lining (Table 1). Hermetic bags and polypropylene bags with polyethylene sheet lining maintained the initial moisture content with slight change. Our present study finding on non-hermetic containers is in agreement with the finding of [11], who find 12% seed moisture for rice variety before storage and find mean moisture content of 14.35%, 17.88% and 11.93% after 2, 4 and 6 months of storage irrespective of storage device.

Thousand seed weight at the outset of the experiment was 60g. After 24 months of storage, the thousand seed weight ranged from 39.4g in polypropylene bags without polyethylene sheet lining to 42.3g in polypropylene bags lined with polyethylene sheet (Table 1).

Table 1. *Effects of packaging materials and storage period on moisture content, thousand seed weight, standard germination, and speed of germination of barley seed.*

Storage period (months)	Packaging materials	Moisture content (%)	Thousand seed weight (g)	Germination percentage (%)	Speed of germination
Initial	All	13.00cd	59.98a	99.75a	21.05abcde
6 months	Jute	13.13cd	42.85bcd	98.25ab	21.54abc
6 months	PPB	13.83bc	43.60bc	98.5a	18.04abcdef
6 months	PPBPE	13.15cd	42.00cdef	98.75a	18.5abcdef
6 months	PICS	12.2d	42.00cdef	99.25a	17.93abcdef
6 months	SGB	12.68cd	41.2cdefg	98.25ab	17.66bcdef
12 months	Jute	12.9cd	40.5defg	99a	22.04ab
12 months	PPB	12.7cd	39.48fg	99.5a	20.96abcde
12 months	PPBPE	12.6cd	39.65efg	99.5a	22.38a
12 months	PICS	12.65cd	41cdefg	98.5a	21.86ab
12 months	SGB	13.03cd	40.10efg	97ab	21.15abcd
18 months	Jute	15.75a	38.80g	86cde	15.66f
18 months	PPB	15.45a	40.4defg	89.0bcde	16.84def
18 months	PPBPE	13.18cd	40.5defg	90.5abcd	16.5ef
18 months	PICS	13.43cd	45.10b	92.5abcd	17.08cdef
18 months	SGB	13.38cd	39.70efg	97.0ab	17.94abcdef
24 months	Jute	15.15ab	39.59fg	81.0e	13.98f
24 months	PPB	15.03ab	39.42fg	84.5de	14.84f
24 months	PPBPE	13.08cd	42.28cde	94.75abc	17.49bcdef
24 months	PICS	13.28cd	40.87defg	97ab	16.82def
24 months	SGB	12.68cd	40.14efg	95abc	16.98cdef
Std. Error		0.25	0.5	1.76	0.86
Tukey's HSD		1.35**	2.68**	9.44**	4.60*
CV (%)		3.75	2.23	3.7	9

Note: Jute= Jute bag, PPB= polypropylene bag without polyethylene sheet lining, PPBE= polypropylene bag with polyethylene sheet lining (Fertilizer bag), PICS= Purdue Improved Crop Storage bag and SGB= Supper Grain Pro bag. Means followed by the same letter(s) at each column and row are not significantly different from each other at 0.05 level of probability.

There were significant (P<0.01) effects of packaging materials, storage period and their interaction for germination percentage. The standard germination percentage of barley seeds remained statistically similar to the initial germination (99.8%) in all packaging materials up to 12 months of storage. Rapid decrease of germination percentage was exhibited by seeds stored in jute bag and polypropylene bag without polyethylene sheet lining after 18 and 24 months of storage. On the other hands, polypropylene bags with polyethylene sheet lining, PICS bags, and Super Grain Pro bags-maintained germination percentage between 94 % and 97%. [11], also reported that seed germination varied significantly in rice variety seeds due to interaction of storage duration and storage devices.

The speed of germination at the outset of storage was about 21.1 seeds per day. The change in speed of germination was statistically non-significant but there was a considerable reduction after 24 months of storage in all packaging materials (Table 1). The lowest rate was recorded for seeds stored in jute bag and polypropylene bags without polyethylene sheet lining after 24 months of storage.

3.2. Seedling Shoot and Root Lengths

There was a significant (P<0.01) effect of seed storage period

for seedling shoot and root length. Seedling shoot length decreased from 15.3cm at the outset of the experiment to 7.6cm after 24 months of storage (Table 2). Similarly, seedling root length decreased from 12.2cm before storage to 7.8cm after 24 months of storage. [11] Observed that both shoot and root length of rice variety decreased as storage period progressed. The reduction in the rate of seedling development after prolonged period of storage could be attributed to the depletion of seed food reserves due to seed deterioration.

Table 2. *Main effect of storage months on shoot length and root length of barley seed.*

Storage period (months)	Shoot length (cm)	Root length (cm)
0	15.34b	12.19a
6	11.83c	9.40a
12	17.29a	12.84a
18	7.79d	7.96c
24	7.63d	7.75c
Std. Error	0.13	0.21
Tukey's HSD	0.50**	0.86**
CV (%)	4.74	9.66

Note: Means followed by the same letter(s) at each column are not significantly different from each other at 0.05 level of probability.

3.3. Seedling Dry Weight, Vigor Indices, Emergence Index

The effects of storage period and packaging materials interaction were significant ($P<0.05$) for seedling dry weight, vigor index-I, vigor index-II, and emergence index. In all packaging materials, seedling dry weight increased up to six months of storage. Seeds exhibited significant decline in seedling dry weight after 12, 18 and 24 months of storage. Lower seedling dry weight is an indication that there was reduce vigor due to seed deterioration.

The vigor index-I, and II at the outset of the experiment were 1542.5 cm% and 52375 mg% (Table 3). Packaging materials such as polypropylene bag with polyethylene sheet lining, PICS bag, and Super Grain Pro bag maintained the initial seedling vigor index-I. There were significant increases in seedling vigor index-II of barley seed stored in all packaging materials at 6 months of storage. Vigor index-II significantly declined at 12, 18 and 24 months of storage, regardless of packaging materials. Vigor index-II is a good indicator of the seed deterioration in barley since it is a function of the seedling dry weight and the germination percentage.

The highest field emergence index, 20.8 seedlings per day was recorded at initial. Changes in field emergence indices were not significant up to six months of storage in all packaging materials (Table 3). Field emergence index significantly reduced after 24 months of storage with lowest values exhibited by seeds stored in jute bag and polypropylene bags without polyethylene sheet lining.

Table 3. *Interaction effect of packaging materials and storage months on seedling dry weight and vigor index one of barley seed.*

Storage period (months)	Packaging materials	Seedling dry weight (mg)	Vigor index - I	Vigor index - II	Field emergence index
Initial	All	525.00d	1542.5bcde	52375d	20.78a
6 months	Jute	805ab	1165.8g	79070ab	18.39a
6 months	PPB	765abc	1216.4fg	75375abc	18.29a
6 months	PPBPE	635cd	1160.7g	62700cd	19.64a
6 months	PICS	865a	1189.2g	85880a	18.01a
6 months	SGB	715bc	1146.3g	70155bc	19.14a
12 months	Jute	290e	1693.2abc	28655e	8.55bcd
12 months	PPB	305e	1827.1a	30360e	6.58cde
12 months	PPBPE	280e	1768.8ab	27930e	11.85b
12 months	PICS	340e	1647.1abcd	33735e	8.75bcd
12 months	SGB	305e	1677.9abc	29480e	7.76cd
18 months	Jute	262e	1335.8efg	20245e	8.61bcd
18 months	PPB	270e	1341.1efg	19340e	7.49cde
18 months	PPBPE	263.5e	1510.1cde	21343e	9.17bcd
18 months	PICS	276e	1473.6cde	23800e	10.51bc
18 months	SGB	274e	1505.9cde	22548e	9.00bcd
24 months	Jute	250e	1220fg	20175e	3.53e
24 months	PPB	277.5e	1239.2fg	23445e	5.24de
24 months	PPBPE	260e	1553bcde	24678e	7.86bcd
24 months	PICS	272.5e	1517.9cde	26413e	8.19bcd
24 months	SGB	270e	1441.9def	25613e	7.66cd
Std. Error		27.91	43.2	2705.3	0.75
Tukey's HSD		149.93*	232.06**	14532*	4.01**
CV (%)		13.16	5.94	13.36	11.72

Note: Jute= Jute bag, PPB= polypropylene bag without polyethylene sheet lining, PPBE= polypropylene bag with polyethylene sheet lining (Fertilizer bag), PICS= Purdue Improved Crop Storage bag and SGB= Supper Grain Pro bag. Means followed by the same letter(s) at each column and row are not significantly different from each other at 0.05 level of probability.

3.4. Seed Health

Data on fungi associated with barely seed stored in different packaging materials for various storage periods are depicted in Table 4. Several fungal genera were associated with barley seed stored in different storage materials for various storage months. The observed fungal genera were *Penicillium*, *Bipolaris*, *Alternaria*, *Botrytis*, *Aspergillus*, *Rhizopus*, *Fusarium, Cladosporium* and *Phoma. A. flavus*

was frequently detected fungi detected in all packaging materials across all storage periods.

3.5. Correlation Coefficient (r) Between Disease Incidence and Other Laboratory Seed Quality Parameters for Barley Seed

Correlation analysis between disease incidence percentage and the other seed quality parameters showed that highly significant associations were observed between moisture content, thousand seed weight, standard germination, speed of germination, shoot length, root length, seedling dry weight, vigor index one, vigor index two and field emergence index (Table 5). Positive correlations were observed between disease incidence with moisture content (r = 0.29), thousand seed weight (r = 0.27), seedling dry weight (r = 0.36), vigor index two (r = 0.29) and field emergence index (r = 0.39). Strongly negative correlation was observed among disease incidence with shoot length (r = -0.50), root length (r = -0.52) and vigor index one (r = -0.63) on the other hand, negative association were observed among disease incidence with speed of germination (r = -0.38) and standard germination (r = -0.30).

Table 4. *Mean percentage of fungi associated with barley seed stored by different packaging materials for various storage months.*

Packaging materials	Storage period (months)	Percentage of fungi associated with barley (HB 1307 variety)				
		Penicillium	*Bipolaris*	*Alternaria*	*Botrytis*	*A.flavus*
Jute bag	6	0.3	0.0	11.8	2.5	11.8
	12	0.0	0.0	11.3	3.0	12.5
	18	0.0	0.0	12.0	2.5	11.8
	24	10.3	0.0	0.0	0.0	15.8
Polypropylene bag	6	0.8	0.0	4.3	0.0	3.5
	12	0.5	0.5	5.0	0.0	3.8
	18	0.5	0.0	5.3	0.0	4.3
	24	2.0	0.0	0.0	0.0	10.3
Polypropylene bag with polyethylene sheet lining	6	0.3	0.0	12.3	0.0	9.8
	12	0.0	0.0	10.5	0.0	10.8
	18	0.0	0.0	11.5	0.0	11.0
	24	0.0	0.8	1.8	0.0	9.5
PICS bag	6	0.3	1.0	13.8	0.3	13.8
	12	0.8	0.8	10.5	0.0	10.8
	18	0.8	0.8	16.8	0.0	15.0
	24	0.3	0.0	1.3	0.0	11.0
Supper Grain Pro bag	6	0.0	0.0	8.8	0.0	9.3
	12	0.0	0.0	8.5	0.0	7.5
	18	0.0	0.0	9.8	0.0	9.3
	24	0.0	0.8	1.0	0.0	6.8

Table 4. *Continued.*

Packaging materials	Storage period (months)	Percentage of fungi associated with barley (HB 1307 variety)						
		A.niger	*Rhizopus*	*Fusarium oxysporium*	*Cladosporium*	*Phoma*	*Infected*	*Incidence*
Jute bag	6	0.0	12.0	3.0	5.3	0.0	46.5	93.0
	12	0.0	14.0	2.8	6.0	0.3	49.8	99.5
	18	0.0	14.8	3.8	5.5	0.0	50.3	100.0
	24	0.0	13.0	1.3	0.0	0.5	5.8	23.3
Polypropylene bag	6	0.5	15.3	1.0	3.5	1.0	29.8	59.5
	12	0.8	15.0	1.3	4.0	1.0	31.8	63.5
	18	0.5	15.0	1.0	4.3	0.0	30.8	61.5
	24	0.0	15.5	0.8	0.0	0.0	4.1	16.3
Polypropylene bag with polyethylene sheet lining	6	0.0	15.3	6.5	4.0	1.0	49.0	98.0
	12	0.0	12.3	7.8	3.5	0.0	44.8	89.5
	18	0.0	16.0	6.3	3.5	1.0	49.3	98.5
	24	0.0	3.8	0.0	0.0	1.5	2.5	9.9
PICS bag	6	0.0	14.3	0.0	1.3	0.0	44.5	89.0
	12	0.0	11.5	0.0	1.3	0.0	35.5	71.0
	18	0.0	17.0	0.0	1.8	0.0	52.0	100.0
	24	0.0	6.3	0.8	0.0	1.0	2.9	11.7
Supper Grain Pro bag	6	0.0	7.8	5.0	6.5	0.0	37.3	74.5
	12	0.0	7.8	3.5	4.5	0.0	31.8	63.5
	18	0.0	8.8	4.5	5.8	0.0	38.0	76.0
	24	0.0	0.0	0.8	0.0	1.0	1.5	5.9

Table 5. *Correlation Coefficients (r) between disease incidence percentage and laboratory seed quality parameters of barley.*

	MC	TSW	SPG	SG	SL	RL	SDW	VI1	VI2	FEI	NSI
MC											
TSW	-0.26*										
SPG	-0.40**	0.05^{NS}									
Ger	-0.64**	0.25*	0.66**								
SL	-0.47**	-0.08^{NS}	0.74**	0.56**							
RL	-0.45**	-0.07^{NS}	0.66**	0.49**	0.89**						
SDWT	-0.26*	0.44**	0.11^{NS}	0.36**	0.17^{NS}	0.06^{NS}					
VI1	-0.27*	-0.26*	0.48**	0.39**	0.53**	0.56**	-0.57**				
VI2	-0.32**	0.45**	0.17^{NS}	0.43**	0.23*	0.12^{NS}	0.99**	-0.51**			
FEI	-0.35**	0.50**	0.19^{NS}	0.43**	0.18^{NS}	0.05^{NS}	0.87**	-0.47**	0.87**		
NSI	0.29**	0.28*	-0.38**	-0.30**	-0.51**	-0.52**	0.35**	-0.62**	0.29*	0.38**	
DIP	0.29**	0.27*	-0.38**	-0.30**	-0.50**	-0.52**	0.36**	-0.63**	0.29**	0.39**	0.99**

Note, ^{NS} **and * indicates non-significant, highly significant at 1% and significant at 5% level of probability respectively. MC= moisture contents, TSW= thousand seed weight, SG=standard germination, SPG= Speed of germination, SL= shoot length, RL=root length SDW=Seedling dry weight, SVI1= seedling vigor index 1, SVI2=seedling vigor index 2, FEI= Field Emergence index, NSI= number of seed infected by different fungi per 50 seed and DIP=Disease incidence percentage.

4. Conclusion

From the overall result moisture content level, thousand seed weight, germination percentage, vigor index one, vigor index two and felid emergence index are affected by packaging materials, storage months and their interaction whereas, shoot and root length are only affected by storage months and speed of germination is influenced by storage months and their interaction. Seed quality was reduced for seed stored in Jute bag as compared to other packaging materials at each storage months. The moisture content of the seeds is one of the most important factors influencing seed viability in storage. As storage period is progressed both moisture content and thousand seed weight were increased for barley seed stored in jute and polypropylene bag without polyethylene sheet lining. Concerning seed viability as germination percentage is usually the best indictor or methods of estimating seed viability both standard germination and speed of germination was rapidly decreased for seed stored in jute bag and polypropylene bag without polyethylene sheet lining for 18 and 24 months and the recorded values are below the acceptable level for standard germination.

According to our study we observed that barely seed stored in supper grain pro bag, PICS bag and polypropylene bag with polyethylene sheet lining (fertilizer bag) improved seed quality parameters at each storage months as compared to non-hermetic storage materials namely jute bag and polypropylene bag without polyethylene sheet lining. Hence, the improvement of seed quality variables by polypropylene bag without polyethylene sheet lining is almost similar to air-tight storage materials it was relatively good to store barely seed in polypropylene bag with polyethylene sheet lining (fertilizer bag) without losing viability for thus farmers who can't afford hermetic storage. On the other hand, after 18 and 24 storage months both shoot and root seedling length of barley seed was rapidly reduced. Similarly, after 12-month storage seedling vigor such as seedling dry weight, vigor index two and field emergence index are reduced for all packaging materials. Generally according to this study as storage month progressed seed vigor testing parameters/variables are significantly reduced for barley seed stored in all packaging materials and the reduction was highest for non-hermetic storage materials namely jute bag and polypropylene bag without polyethylene sheet lining. Concerning Storage fungi several fungal were associated with barley seed. The observed fungal are *Ascochyta* sp, *Penicillium* sp, *Bipolaris sp*, *Alternaria* sp, *Aspergillus* sp, *A.flavus*, *A.niger*, *Rhizopus*, *Eppiccocum nigrum*, *Trichoderma, Fusarium* sp and *Botrytis* sp*, Cladosporium* and *Phoma sp.* Barley seed stored for 24 months in all packaging materials recorded lowest diseases infection as compared to other storage months. The highest diseases incidence was observed for seed stored in jute bag for all storage months as compared to other packaging materials followed by seed stored in polypropylene bag with polyethylene sheet lining and relatively less diseases incidence was observed for seed stored in supper grain pro bag at all storage months as compared to other storage materials. Correlation analysis between disease incidence percentage and the other seed quality parameters showed that highly significant associations were observed between moisture content, thousand seed weight, standard germination, speed of germination, shoot length, root length, seedling dry weight, vigor index one, vigor index two and field emergence index.

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