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IMPACT OF STORAGE PACKING MATERIAL ON TRUE POTATO SEED (TPS) SEEDLING TUBERS AND COMMERCIAL VARIETY TUBERS DURING COLD STORAGE

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ABSTRACT

To determine the appropriate packing material for true potato *(Solanum tuberosum)* seed (TPS), seedling tubers and Potato standard variety tubers during cold storage, the present study was conducted at Agriculture Research Institute, Tandojam, Pakistan located at 25.24, 46.00,'N, 68.32, 12.00E during 2009 and 2010. In this study tubers of three genotypes viz, TPS=9802, TPS=9804, TPS=9805 and standard potato variety Diamant were stored in five different packing materials viz. gunny bag, polyethylene bag, cloth bag, netted bag and wooden crate. The results obtained from 500 g standard weight of sample. The maximum tuber weight (485.0 g) was recorded in TPS-9804 genotype kept in gunny bags. However, minimum tuber weight (262.6 g) noted by Diamant variety stored in polyethylene bag.The maximum tuber rottening (17.79%) was recorded in Diamant variety stored in polyethylene bag as packing material. However, the minimum tuber rottening (3.10%) was found in TPS-9804 genotype when tubers were stored in gunny bag. After taken out of material from cold storage, tubers were kept without packing material at room temperature of 20-25 ^{0}C for sprouting up to ten days. Than the higher tuber sprouting (92.64%) was found in TPS-9804 genotype stored in gunny bags and lower tuber sprouting (51.95%) was recorded in Diamant variety stored in polyethylene bag. Hence TPS- 9804 genotype recommended for potato growers of Sindh province due to its better storage capability using gunny bag as packing material.

Keywords: Potato, genotypes, diamant, seedling tubers, packing material.

INTRODUCTION

Over one billion people in different countries consume potatoes (Khurana *et al.*, 2003). This crop has the capacity to solve the food security problem and its product consumption indicates the need to pay more interest on consumer behavior and innovations in the sector (Buono *et al.*, 2009; Abong *et al.*, 2011).

Potatoes can be used in many ways, but producing fresh potatoes throughout the year is unfeasible, long-time storage is essential (Uwe, 2001). More than 85% of potato production takes place during the winter season (Oct-Nov to Feb-Mar) and potatoes must be stored in cold stores for ware potatoes to meet the demand from May to October (Khatana and Upadhya 1994). Due to storability, potatoes become available in the market throughout the year even in the areas where production is seasonal. To avoid high seasonal price fluctuations, storage technology helps to manage risk (Fuglie, 1999). Storing potatoes for longer period in normal temperature is not possible as it is a living material and through respiration the changes occurs due to heat, resulting in loss of dry matter and ultimate deterioration of quality of tubers (Eltawi *et al.*, 2006). The cold storage losses accounts for 3-10% of the stored product in the form of rottening, cold injury, weight loss and sprouting as narrated by Chourasia and Goswami (2009); potatoes are usually kept in cold storage until required for the market, storage conditions and length of time influence potato quality and their consequent susceptibility to handling.

Devendra *et al*. (1998) stored the five TPS lines from March 15 to June 15. Popular cultivars Kufri Badshah, Kufri Bahar and Kufri Chandramukhi were used as control. After 60 days of storage, the sprouting was significantly higher (75-100%) in all the TPS lines than in the controls (40-70%), whereas the rotting was either significantly lower or equal to Kufri Chandramukhi (0.5%), The weight loss in all TPS lines, except HPS 7/67 was moderate (7.2-7.6%) and comparable to Kufri Bahar (7.4%). After 90 days, sprouting was 100% in all TPS lines as well as in the controls. Weight loss in TPS lines HPS, 11/13, 1/67 and 11/67 was moderate (14-15% and comparable to Kufri Bahar 14.6%), but was higher than that of Kufri Chandramukhi (9.9%). These three lines also showed lower rotting than Kufri Bahar. Tuhin *et al.* (2006) compared storability of tubers obtained from 9 hybrid TPS progenies with non-TPS cultivar Diamant. The results of correlation analysis among parameters also indicated that the storability of the TPS progenies was superior to that of Diamant. Rosenfeld *et al.* (1995) studied the potato variety BEATE packed in different colored paper, polyester mesh and polyethylene bags and reported highest content of glycol alkaloids in a blue polyethylene bag. Storage management is an important factor in the successful utilization of new potato cultivars and its loss in cold storage is a problem confronting all the potato producing industry (Brandt *et al.*,

2004). Packing materials used in storage perform several functions like insulation against fluctuating temperatures, moisture retention and reduction of disease transmission.

Packaging technique and material used for the purpose is most important and helps a lot in protecting food products from outside influences and damages; accordingly selection of proper material for packaging not only ensures sustainability of food contents of packed material but maintains the amount and form of the required ingredient and nutrients (Balev *et al.,* 2011). Consequently, in this study five packing materials i.e. gunny; polyethylene; netted; cloth bags along with wooden crate were compared for cold storage of seedling tubers. 500 g standard weight of tubers from each treatment were taken and packed in the material prescribed above.

MATERIALS AND METHODS

Five hundred gram of seedling tubers from each true potato seed genotype i,e, TPS-9802, TPS-9804, TPS-9805 and standard Potato variety Diamant were kept in cold storage at 2-5 ^{0}C from March - October to record the behavior of TPS seedling tuber in comparison with the tubers of standard variety Diamant. With four replications five different types of packing materials viz, Gunny bag, Polyethylene bag, Cloth bag, netted bag, and wooden crates were used. All the samples were weighed before and after storing to determine the tuber weight losses during storage period. The data regarding the rottening of tubers during storage period recorded. However, the sprouting percentage of tubers was recorded after taken out of material from cold storage to room temperature after ten days.

The collected data analyzed by procedures of Gomez and Gomez (1985) through MSTAT-C package. For mean discrimination Duncan's Multiple Range Test (DMRT) was applied.

RESULTS AND DISCUSSION

The results regarding the response of genotypes on different tuber traits as affected by storage packing material, obtained from 500 g standard weight of sample. The higher tuber weight (394.8 g) recorded after storage in genotype TPS-9804, followed by 377.0 and 354.8 g in TPS-9802 and TPS-9805 genotypes respectively. However, the lower weight of tubers (335.7 g) after storage was recorded in the standard variety Diamant. Similarly Devendra *et al*. (1998) also recorded variation amongst genotypes towards packaging period and material. The results for effect of storage packing material showed higher (468.3 g) tuber weight when potato tubers were stored in gunny bags. However, lower tuber weight (289.4 g) was observed in polyethylene bag. All the packing materials showed significant differences with each other. Potatoes shrink or lose weight during cold storage as per statement of Tuhin *et al*. (2006) and Chourasia and Goswami (2009) also reported that potato tuber, being a living organism, undergoes metabolic changes as a result of vital functions (Table.1).

Table 1. Impact of storage packing material on tuber weight.

S. No:	Factor A: Storage packing material	Factor B: True potato seed genotypes				Mean
		TPS- 9802	TPS- 9804	TPS- 9805	Diamant	
1	Gunny bag	471.9 b	485.0 a	465.0 b	451.6 c	468.3 A
2	Polyethylene bag	310.4 i	309.0 i	275.5 k	262.6 i	289.4 E
3	Cloth bag	364.3 g	382.3 f	346.1 h	311.9i	351.1 C
4	Netted bag	397.4 e	437.4 d	382.6 f	365.0 g	395.6 B
5	Wooden crates	341.0 h	360.4 g	304.7 i	287.5 j	
	Mean	377.0 B	394.8 A	354.8 C	335.7 D	323.4 D

Factor A:**SE:** 1.730; **LSD** (5%) 4.844
Factor B:**SE:**1.934; **LSD** (5%)5.416

Results of the study showed maximum tuber rottening (9.59%) in Diamant variety and the minimum rottening of tubers (5.90%) was observed in TPS-9804 genotype.Whereas for storage packing material the maximum tuber rottening (14.11%) recorded in polyethylene bag. However, minimum tuber rottening (4.15%) was found in gunny bag packing material. This may be due to retention of high moisture in polyethylene bag and more infestation, these findings confirms findings of Wong and Rajoo (2003), according to whom, moisture is known to be a damaging agent due to high temperature in plastic packaging (Table 2).

Table 2. Effect of storage packing material on rottening (%) of tubers.

S. No:	Factor A: Storage packing material	Factor B: True potato seed genotypes				Mean
		TPS- 9802	TPS- 9804	TPS- 9805	Diamant	
1	Gunny bag	3.62 kl	3.10 i	4.40 j	5.48 i	4.15 E
2	Polyethylene bag	12.97 c	10.82 d	14.86 b	17.79 a	14.11 A
3	Cloth bag	8.21 f	6.65 h	9.53 e	9.99 e	8.60 B
4	Netted bag	4.36 j	3.73 k	5.79 i	6.58 h	5.11 D
5	Wooden crates	5.54 i	5.20 i	7.45 g	8.11 f	
	Mean	6.94 C	5.90 D	8.41 B	9.59 A	6.57 C

Factor A:**SE:** 0.08888; **LSD** (5%) 0.2489
Factor B:**SE:**0.0997; **LSD** (5%) 0.2783

The maximum tuber sprouting (84.35%) was noted in TPS-9804 genotype, followed by, 79.19 and 71.94% sprouting in TPS-9805 and TPS-9802 genotypes respectively. The lower (67.26%) tuber sprouting was recorded in Diamant variety. For storage packing material the higher tuber sprouting (84.15%) was noted in gunny bag, whereas, lower tuber sprouting (58.64%) was recorded in polyethylene bag packing material.

In this study packaging in gunny bag proved superior in case of all the genotype. This might due to the fact that in gunny bag proper atmosphere was available to the tubers for respiration which caused less infestation to the tubers. Rosenfeld *et al*. (1995) is of same views. This study also supported by Kumari *et al*. (2001),Tuhin *et al*. (2006) and Bisognin *et al*. (2008) (Table 3).

Table 3. Effect of storage packing material on sprouting (%) of tubers after cold storage.

S. No:	Factor A: Storage packing material	Factor B: True potato seed genotypes				Mean
		TPS- 9802	TPS- 9804	TPS- 9805	Diamant	
1	Gunny bag	80.85 d	92.64 a	92.64 a	75.33 fg	84.15 A
2	Polyethylene bag	56.69 k	64.84 i	64.84 i	51.95 i	58.64 E
3	Cloth bag	74.76 g	88.19 b	88.19 b	71.12 h	78.71 C
4	Netted bag	76.94 ef	91.46 a	91.46 a	72.31 h	82.14 B
5	Wooden crates	70.49 h	84.64 c	84.64 c	65.58 i	
	Mean	71.94 C	84.35 A	79.19 B	67.26 D	74.79 D

Factor A:**SE**0.3220; **LSD** (5%) 0.9019
Factor B:**SE:**0.0997; **LSD** (5%) 0.2783

It can be concluded from the study that the maximum tuber weight (485.0 g) and maximum tuber sprouting (84.15%) was recorded in TPS-9804 genotype kept in gunny bag as compared to stored polyethylene. The maximum tuber rottening (17.79%) was recorded in Diamant variety stored in polyethylene bag as packing material. It is also observed that the TPS tubers have ability to overcome and survive in severe conditions during storage and have ability to retain moisture as well as enhanced shelf life of tubers. This will be beneficial impact for marketing point of view and keeping the seed tubers for long time.

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