Research Article

EFFECT OF DEHAULMING AND STORAGE CONDITIONS ON POSTHARVEST PARAMETERS OF POTATO

Abstract

Potatoes are the fourth most important food crop in the world. Two thirds of them are consumed by humans, while the other third is used as animal feed, potato starch, and in the manufacturing of pharmaceuticals, textiles, adhesives, paper products, and other products. Two factorial Complete Randomized Design with two level of treatment combination was applied throughout the experiment. During the experiment, dehaulming and non-dehaulming practice was performed and the potatoes were stored in three different storage conditions (Cold storage, Bamboo basket and Gunny bags). The superiority of rotting was recorded in gunny bags followed by bamboo basket and cold storage. Similarly, maximum sprouting was observed in bamboo baskets with minimum in cold storage. The maximum final weight loss was observed in bamboo basket followed by gunny bag and cold storage. The superiority in greening was observed in gunny bags whereas minimum in cold storage. Non-dehaulmed potatoes showed maximum loss in observed parameters whereas dehaulmed potatoes showed minimum loss. The interaction effect of dehaulming and non-dehaulming with different storage conditions had significant effect in rotting at 20days and in sprouting at 40days whereas was non-significant in final weight loss and greening. Among all the storage conditions used, best result was obtained in cold storage with minimum storage loss. The farmers are suggested to use dehaulmed potatoes with the storage under cold store. As the potato was stored in 10-12 degree Celsius, there was no sweetness in the cold stored potatoes so preferred by the consumers for table purpose. Therefore, it is suggested to conduct similar research in different location using other varieties along with dehaulming practices.

Keywords: potato, dehaulming, cold storage, bamboo basket, gunny bags.

1. Introduction

In Nepal, potatoes (Solanum tuberosum L.) are a crop that is increasingly yielding income. It has become a diverse vegetable crop across the nation due to its increased use in numerous Nepalese foods, but it is still a staple diet for people living in high hills and mountains. According to the reports, Nepal has 195,173 hectares of land under potato crop with the total production of 2,881,829 tons of potatoes overall, and has an average productivity of 14.7 t/ha, which is less than that of its closest neighbors (MoALD, 2019). Potatoes are ranked fifth on area covered, second on total production and first on productivity in Nepal (MoALD, 2021). According to the recent study, the area, production and yield of potato were found 1876ha, 28900mt and 15.41mt/ha respectively in Udayapur (MoALD, 2021).

Dehaulming is the practice of removing the aerial parts of a plant 10-15 days before harvesting (“Dehaulming in potato”, 2018). According to Lutaladio et al. (2009), dehaulming can be carried out after the yellowing of aerial parts, as this signifies the potato's maturity. Dehaulming extends the shelf life of potatoes by hardening the tubers. The potato tubers are left in the field for 2-3 weeks after dehaulming so that the skin of potato hardens and reduces the damage during postharvest handling (Potato Vocabularies Explained, 9 Mar 2020). The dry matter weight percentage of the potato flesh was measured periodically after storage for two harvest times: 12 days and 0 days after dehaulming. When compared to potatoes harvested right away after dehaulming, potatoes collected 12 days after dehaulming showed consistently greater dry matter weight percentages throughout the storage period. During storage, both sample's dry matter weight percentages showed an increasing trend, with the initial group's percentages generally being greater (Nipa et al, 2013).

Postharvest loss refers to any change in the produce after harvesting that hinders the normal consumptions. Postharvest loss of potato was estimated to be 25% in Nepal, 24% in India and 20% in Bangladesh (Karki, 2002; Prasad et al., 1989; Satter et al., 2002). From the study, the losses of potato during postharvest storage were estimated between 15-20% in Nepal (Bhattarai, 2018). The loss of potato tubers was found to be 12.08% per hectare in average in various supply chain stages (Kuyu et al., 2019).

Harvested potatoes are kept into storage before being distributed to the market. The main goals of storage are to preserve quality, prevent infestation of disease and pest, regulate supply and provide security to the product. It is necessary to maintain the unique microclimatic characteristics at each stage of potato storage, such as temperature and relative humidity (Potato Storage Technology, 2020). Though traditional methods of storage suffer considerable losses, the number of farmers relying on the traditional methods of potato storage is increasing (Rhoades, 1985). The main reason for increasing the use of local methods of potato storage are cheap and easy handling as well as the potatoes taste better than that of stored in cold storage (Dahiya et al., 1997).

1. Botanical description of potato

The potato (Solanum tuberosum) is a starchy tuber native to America and belonging to the Solanaceae family (Britannica, 2022 November 11). It primarily undergoes cross-pollination by insects but can also self-pollinate (Amador, 2009). Vegetative propagation through planting tuber fragments or botanical seeds is common, with ideal sprouting conditions resulting in desirable characteristics (Singh and Kaur, 2009). Comprising 77.5% moisture, 19.4% carbohydrate, 2% protein, 0.6% fiber, and 1% ash, potatoes are a versatile crop grown worldwide (Gould, 1999).

According to Theisen and Compilan (2010), potatoes are a winter crop in the terai and low hills, a spring and autumn crop in the mid-hills, and a summer crop in the high hills and mountains. In Nepal, potatoes are often sown in late September or early October. Potato harvesting can begin as soon as two months after sowing (Dhital, 2000). Two thirds of potato are consumed by humans, while the other third is used as animal feed, potato starch, and in the manufacturing of pharmaceuticals, textiles, adhesives, paper products, and other products (Ehler, 2015).

2. Potato variety

There are many varieties grown in eastern part of Nepal. The mainly grown commercial varieties are Lal gulab, Kurfi Sinduri (C140 or C40), Chisapani, llam blue, Phulwa, Letang white and so on. Lal gulab is the terai grown variety which is round red in color with thick and scaly skin. It has uniform size and highly valued for consumption with good keeping quality. It does not deteriorate as rapidly as other varieties and have high market value (Rhoades, 1985).

3. Postharvest loss of potato

The losses that occur during the period between maturity of crop and the time of its final consumption are called postharvest losses (Grieig and Reeves, 1985). Potato postharvest losses are mostly caused by water loss, mechanical damage, physiological damage, illness, and pest infestation (www.fao.org/docrep/008/a018e/a01850c.htm). According to Sudheer and Indira (2007), inadequate harvesting, transportation, marketing, and legal frameworks provide the right environment for secondary causes of loss. To avoid losing weight, rotting, shrinking, sweetening, greening, and sprouting, potatoes should be stored in an appropriate environment (Gotts Chalk and Christenbury, 1998).

Postharvest losses can be the result of a qualitative or quantitative losses (Aulakh et al., 2013). A product's acceptability, edibility, and nutrient composition are all impacted by quality losses. Losses of a product's quantity are included in quantity losses (Kaiya, 2014).

4. Impact of dehaulming on postharvest and qualitative aspects

Dehaulming is the process of removing the potato plant's vegetative portion from its above-ground root tubers (Potato Vocabularies Explained, 9 Mar 2020). When dehaulming delayed from 70 to 90 DAP, there was a notable decrease in the reducing sugar level and an improvement in tuber quality (Marwaha et al, 2012). After peeling or cutting, phenolic acid and flavonoids induce enzymatic discoloration (Marwaha et al, 2010).

5. Types of storage systems

Following are the major storage methods practiced in Nepal:

A. Conventional methods for storing potatoes

- Storage in bhakaris
- Pit storage/Clamps dug in the ground
- Heap storage
- Storage with the use of chemicals
- Bamboo baskets lined with soil and straw
- Sack storage (Gautam, 2014)
- Room storage

B. Modern methods of storage

- Cold storage (Theisen and Campilan, 2010)
- Stored in diffused sunlight (Anon, 2004)

The people of Udayapur are facing the problem of postharvest loss and potatoes greening during storage. Hence, this experiment was performed under farmers condition to study the effect of harvesting parameters and postharvest losses of potato under different storage conditions.

6. Room storage

Room storage is the traditional storage practices followed over all the ecological regions of Nepal. In such storage systems potatoes are spread out in a dark room under the beds or corners to dry for about 7-10days after harvesting (Rhoades, 1985). This storage technique is mainly practiced to devoid sunlight from the potatoes during storage period as when potatoes are exposed to strong light, they got materially injured for table purposes. The injury thus occurred is due to the greening of the tubers and development of alkaloid called solanine in the outer layer and around the eyes causing issues to human health. The problems reported following this storage is, this is space consuming as the potatoes are spread all over the floor which decreases the seed stock vigor and uniformity due to excessive sprouting (Khatana et al., 1997).

7. Storage in bamboo baskets

In this practice, the bamboo baskets locally known as doko (average sized) lined up with sand from outside and mud from inside is left to dry well in the sunlight. Potatoes are then well mixed with dry mustard straw and kept in the bamboo baskets in the dark room. Dry mustard straw is used to create dry and cool conditions within storage area (Mutandwa and Gadzirayi, 2007). It also prevents the further moisture loss from potatoes (Rhoades, 1985). The holes in the basket provides the proper ventilation and prevents overheating.

8. Low temperature storage

Cooling the product after harvesting controls the rate of quality loss by decreasing the rate of respiration. The higher the temperature, faster is the deterioration and lower the shelf life of the product so the temperature should be lowered to increase the storage life of product (Sakare, 2014). In cold stores, seed potatoes should be kept between 2-4°C and 90-95% RH to prevent sprouting and minimize weight loss. Once removed from storage, potatoes kept in a cold environment do not keep well, hence it is recommended to store potatoes at 10–12°C for processing and table use because at this temperature potato do not become sweet minimizing the accumulation of reducing sugars (Singh, 2016).

9. Effect of different storage conditions on postharvest loss

Low temperature storage, cold storage, root cellar storage, traditional clamp storage, pit storage, bamboo baskets storage, gunny bags and normal room storage, hanging baskets are the major storage techniques practiced in Nepal (Rhoades, 1985). Postharvest loss decreases the quantity and quality of crop due to improper storage, handling, transportation and market infrastructure. The total postharvest loss was found 4.383%, 8.539% and 13.043% in cold storage, in-basket storage and in-house storage conditions respectively. With cold storage, reducing sugar reached a maximum value of 1.04% as storage time climbed. In potatoes, post-harvest losses ranged from 20 to 30 percent, and occasionally as high as 50 percent (Karki, 2002; Rasheed and Shareef, 2002; Wijeratnam, 2002). According to Khanal and Bhattarai (2020), among the three storage conditions monitored during the experiment, cold storage (2–5ºC/85–90%RH) produced the least amount of storage loss, but room storage (25–33ºC/75–85%RH) produced the most.

2. Materials and Methods

2.1 Harvesting of potato tubers

Potato tubers were harvested after the yellowing of aerial parts and left for curing before storage. The potatoes were then sorted and kept in storage after 10days of harvesting. Rotten and deteriorated tubers were discarded and fresh tubers each sample weighting about 5kg were sorted out for the experiment purpose.

2.2 Preparation of storage structures

The storage in normal room temperature was done by placing the potato tubers in gunny bags. Bamboo basket locally known as doko (average sized) was lined with mud and sand and mustard straw were procured for bamboo basket storage and arranged. The primary use of straw is to regulate the humidity and accessibility. For the easy availability of laboratory analysis and convenience during the study, environment of low temperature storage was recreated in cold storage (Model: A7060 – 353A, Capacity: 7ton Power supply: 230V.60Hz). Maintenance of these conditions were confirmed with the use of hygrometer throughout the storage period (Model: HTC-1).

2.3 Equipment used

General equipment like digital weighing balance, hygrometer, cold storage, spade, sickle, etc were used during the entire study period. Digital weighing balance and hygrometer were brought from the laboratory of Mahendra Ratna Multiple Campus, Ilam.

2.4 Experimental procedure

Each storage unit was loaded with 5kg of fresh, healthy potato tubers following variety selection and careful sorting of similar-sized tubers. Tubers were organized in bamboo baskets with chopped mustard straw between layers after the baskets were lined with mud and sand and allowed to dry for a day. For room storage, the tubers were stored in gunny bags; for cold storage, they were packed in sacks. Four replications of such specimens were conducted in order to acquire accurate results.

For each sample, the experimental data was recorded every 20 days up to an 80-day period. Analysis was done for final weight loss percentage, greening, sprouting, and rotting during the storage period. At the conclusion of the 80-day storage period, the weight of each sample under storage conditions was measured in order to estimate the overall loss.

2.5 Treatments and Experiment Design

The experiment was started from 28 January, 2023 to 1 June, 2023 in farmer's field condition at Belaka municipality of Udayapur district as it is one of the significant potato growing area. Belaka municipality was declared multiple crop zone including potato as a core crop on 2021/2022. The site is located geographically at 26°42'09" N- 86°55'38" E latitude and 26°55'38" N – 87°10'06" E longitude with the elevation of around 150masl.

The variety selected for research was lalgulab. With four replications and six treatments, the design was set up in a two factorial Completely Randomized Design (CRD). Each sample was considered as one treatment. Factor A includes the storage conditions (Cold storage, Bamboo basket and Gunny bags) whereas Factor B includes the dehaulming and non-dehaulming practices with treatment combination A×B.

Table1: Detail of treatments

S.N.	Treatment
T1	Dehaulming + bamboo basket lined with mud and straw
T2	Dehaulming +gunny bag in normal room temperature

T3	Dehaulming + cold storage
T4	Without dehaulming + bamboo basket lined with mud and straw
T5	Without dehaulming +gunny bag in normal room temperature
T6	Without dehaulming + cold storage

2.6 Data Collection

Potato variety lalgulab was taken as a sample. The sample were collected from the dehaulmed and non-dehaulmed field. After dehaulming, the potatoes were left in the field for 15 days and then harvesting was done. All the samples were harvested in the same day and left for curing for 10days. Then, all the samples were placed in different storage conditions and the changes was noted in the interval of 20 day. Total four data were collected.

2.6.1 Parameters Observed

(1) Weight loss Percentage (%)

Total weight loss = Initial weight of tubers – Final weight of tubers

Final weight loss (%) = Total weight loss ÷ Initial weight of tubers × 100

(2) Sprouting Percentage (%)

Total loss % = Weight of sprouts ÷ Total initial weight of tubers × 100

(3) Damage due to rotting Percentage (%)

Total rotting % = Weight of deteriorated tubers ÷ Total initial weight of tubers × 100

(4) Greening percentage (%)

Greening (%) = Weight of green tubers ÷ Initial weight of tubers × 100

2.7 Data analysis

First, the gathered data was cleaned up, tallied, and entered into MS-Excel LTSC 2021. R-stat Version 4.2.1 statistical software was utilized to analyze the entered data and derive significant conclusions. The Honestly Significant Difference Test (HSD) was used to compare the mean of the examined parameters at the 5% significance level. The significance difference of each parameter was tested using an ANOVA.

3. Results and Discussion

3.1 Rotting Percentage

Rotting percentage generally varies as per the difference in the storage conditions where potatoes are stored. The results obtained during the study showed that in all cases i.e., at 20, 40, 60 and 80 days, the rotting percent was found highly significant in the storage conditions. Non-dehaulmed potatoes showed significant difference in rotting at 20days interval followed by non-significant difference at 40, 60 and 80days interval. The maximum rotting percentage was observed 8.30% in gunny bags and the minimum rotting percentage was recorded 0% in cold storage. The interaction between two factors was found significantly different in 20days but no variation was observed in 40, 60 and 80days.

Loss due to the changes in moisture and respiration rate was observed in potato stored inside house in gunny bags as the relative humidity and temperature are not controlled which causes a potatoes to rot and directly affects the weight loss of potato greatly reducing the market value of tubers (Keasar et al., 2005). The obtained result was similar to my findings.

Because mustard straw is used instead of dry straw, which inhibits transpired vapour from condensing on the surface of tubers, the percentage of degradation in the bamboo basket was lower than in the gunny bags. Thus, prevents an overly wet environment in the storage area. By doing this, fungal diseases—which typically thrive in warm, humid environments—are prevented from developing (Mutandwa & Gadzirayi, 2007). According to Knutsson (2012), straw absorbs condensed water produced by the tuber's respiration, which may increase the presence of microorganisms and validate the results of my study.

According to Ezekiel and Dahiya (2002), decaying losses in room storage was 4.7%, but losses in heap storage was 3.8%. However, according to Singh et al. (2014), rotting causes roughly 10–12% of the loss in a typical storage method. The observed outcome shows 8.30% of the maximum loss.

Table 2: Effect of dehaulming and storage conditions on rotting percentage of potatoes

	Rotting			
Treatment	**20days**	**40days**	**60days**	**80days**
	Factor A			
Cold storage	0 ± 0^{c}	2.10 ± 0.18^{b}	3.19 ± 0.19^{b}	4.75 ± 0.26^{b}
Bamboo basket	1.15 ± 0.07^{a}	2.78 ± 0.20^{b}	3.69 ± 0.21^{b}	4.87 ± 0.20^{b}
Gunny bags	0.66 ± 0.03^{b}	3.60 ± 0.21^{a}	5.94 ± 0.24^{a}	8.30 ± 0.24^{a}
LSD	0.11***	0.76***	0.80***	0.88***
	Factor B			
Non-dehaulming	0.64 ± 0.16^{a}	2.74±0.27	4.28±0.45	3.66±0.35
Dehaulming	0.56 ± 0.12^{b}	2.91±0.20	4.26±0.34	4.60±0.34
LSD	0.07*	0.51NS	0.54NS	0.59NS
	Interaction (A×B)			
LSD	0.20**	1.34NS	1.42NS	1.56NS

CV%	15.34	21.21	14.83	11.61
Grand mean	0.60	2.83	4.27	5.97

Table 3: Effect of dehaulming and storage conditions on rotting percentage of potatoes (Interaction)

	Rotting at 20days	
Treatment	**Non-dehaulming**	**Dehaulming**
Cold storage	0^{d}	0^{d}
Bamboo basket	1.3^{a}	1^{b}
Gunny bags	0.64^{c}	0.69^{c}
CV (%)	15.34	
LSD ($_{0.05}$)	0.20**	
Grand mean	0.60	

Note: The common letter (s) within the column indicate the non-significant difference based on HSD Test at 5% level of significance. Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 '' 1. The ± values represent the standard error of the mean.

3.2 Sprouting Percentage

At 20days of storage period, no any signs of sprout growth were seen in both dehaulmed and non-dehaulmed samples followed by storage conditions. The maximum sprouting percentage was observed (87.38%) in bamboo basket and the minimum sprouting percentage was recorded (0%) in cold storage. Dehaulmed and non-dehaulmed potatoes were found significantly different in 40 and 80days.The interaction between two factors was found significantly different in 40days.

After harvest, sprouting takes some time. The dormant phase is a span of time that exists (Dris and Jain, 2004) because of which, there was no any significant difference over the span of 20 days. Kaul and Mehta (1999) reported that after 15 weeks of storage, the weight loss resulting from sprouting is 0.6% for Kufri Phulwa and 0.67% for Kufri Sinduri. Because variety affects both dormancy and the amount of sprouting, the Lal gulab variety's acquired result differs significantly from the other varieties in this study (Mani & Hannachi, 2015). Given that the sprouting phenomena is primarily temperature-dependent (Khanal and Bhattarai, 2020), the temperature increase throughout the storage period (31ºC–44ºC) compared to the ambient temperature (29ºC) is the reason for the noticeably larger loss in bamboo basket storage.

Table 4: Effect of dehaulming and storage conditions on sprouting percentage of potatoes

	Sprouting			
Treatment	**20days**	**40days**	**60days**	**80days**
	Factor A			
Cold storage	0±0	1.23±0.14	9.85±0.29[c]	43.22±0.59[c]
Bamboo basket	0±0	1.01±0.07	24.95±0.68[a]	87.38±1.02[a]
Gunny bags	0±0	1.18±0.08	15.27±0.57[b]	64.66±1.48[b]
LSD	0NS	0.24NS	1.80***	3.37***
	Factor B			
Non-dehaulming	0±0	1±0.06[b]	17.07±2.11	66.65±5.59[a]
Dehaulming	0±0	1.28±0.08[a]	16.31±1.72	63.53±5.37[b]
LSD	0NS	0.16**	1.21NS	2.26**
	Interaction (A×B)			
LSD	0NS	0.43**	3.17NS	5.94NS
CV%	0	16.94	8.47	4.06
Grand mean	0	1.14	16.69	65.09

Table 5: Effect of dehaulming and storage conditions on sprouting percentage of potatoes (Interaction)

	Sprouting at 40days	
Treatment	**Non-dehaulming**	**Dehaulming**
Cold storage	0.88[b]	1.59[a]
Bamboo basket	0.89[b]	1.14[b]
Gunny bags	1.22[ab]	1.13[b]
CV (%)	16.94	
LSD ($_{0.05}$)	0.43**	
Grand mean	1.14	

Note: The common letter (s) within the column indicate the non-significant difference based on Honestly Significance Difference test at 5% level of significance. Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 '' 1. The ± values represent the standard error of the mean.

3.3 Final Weight loss Percentage

Maximum final weight loss percentage was recorded in bamboo basket (14.20±0.64). The minimum final weight loss percentage was recorded in gunny bags (3.22±0.62). Non-dehaulmed samples shows higher percentage of final weight loss followed by dehaulmed samples. No any signs of significant difference were observed in the interaction between two factors.

When storage temperature is lowered, tuber weight loss decreases, and cold storage is the best way to maintain tuber weight (Aharoni et al., 2007). It is because as compared to other storage conditions, cold storage has a lower storage temperature (10–12ºC). As sprouted tubers lose a greater amount of weight than unsprouted ones (Azad et al., 2017), the higher sprouting rate in the bamboo basket accounts for the larger weight loss that is ultimately experienced in the bamboo basket.

According to Mutandwa and Gadzirayi (2007) a moderately warm and dry atmosphere can be created inside the basket by mixing straw, mud and the inherent qualities of bamboo. Warmth accelerates the rate of moisture evaporation from the potato resulting in greater weight loss over time. But in cold storage, the temperature was maintained cool and humid due to which the rate of evaporation slow down and enhance the shelf life of potato.

Table 6: Effect of dehaulming with different storage conditions on final weight loss percentage of potatoes

	Final weight loss percentage			
Treatment	**20days**	**40days**	**60days**	**80days**
	Factor A			
Cold storage	3.27±0.78[b]	6.11±0.74[ab]	8.29±0.73[b]	11.08±0.77[b]
Bamboo basket	5.32±0.61[a]	7.53±0.64[a]	10.86±0.65[a]	14.20±0.64[a]
Gunny bags	3.22±0.62[b]	5.36±0.81[b]	10.07±0.71[a]	12.55±0.77[ab]
LSD	1.40**	1.78*	1.62**	1.74***
	Factor B			
Non-dehaulming	5.40±0.52[a]	7.80±0.59[a]	11.16±0.51[a]	14.14±0.56[a]
Dehaulming	2.48±0.30[b]	4.87±0.29[b]	8.32±0.43[b]	11.08±0.49[b]
LSD	0.94***	1.20***	1.09***	1.17***
	Interaction (A×B)			
LSD	2.47NS	3.15NS	2.86NS	3.06NS
CV%	27.90	22.11	13.07	10.82
Grand mean	3.94	6.33	9.74	12.61

Note: The common letter (s) within the column indicate the non-significant difference based on HSD Test at 5% level of significance. Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 '' 1. The ± values represent the standard error of the mean.

3.4 Greening Percentage

Very highly significant difference was observed in data of 20, 40, 60 and 80days. Maximum greening percentage was recorded in gunny bags (18.15±0.59). The minimum greening percentage was recorded in cold storage (0±0). Non-dehaulmed samples shows more greening than dehaulmed samples. No any signs of significant difference were observed in the interaction between two factors.

Buck, R.W., Akeley, and R.V. (1967) came to the conclusion that maturity, storage temperature, storage duration, each influenced the degree of greenness. All of the studied varieties responded to greening in the same way, though to varying degrees.

Tanios et al. (2018) stored potatoes in light or darkness for up to 8 days at 5, 10 and 25ºC. The level of chlorophyll accumulation that resulted in the greatest amount of greening was at 20ºC. Since, potato stored in gunny bag in a room temperature ranges the temperature more than 25ºC during my storage period so it may have caused the maximum greening in gunny bags. Chlorophyll synthesis in potato is slowed down by cold temperatures in the range of 4 to 10ºC. The low temperature in cold storage inhibits the formation of chlorophyll, further limiting the greening process with the faster rate of greening at room temperature (Folsom 1947; Kozukue and Mizuno 1990; Edwards and Cobb 1997). Due to the controlled condition inside cold storage, the greening was observed in minimum rate.

Table 7: Effect of dehaulming with different storage conditions on greening percentage of potatoes

	Greening			
Treatment	**20days**	**40days**	**60days**	**80days**
	Factor A			
Cold storage	$0±0^c$	$3.97±0.21^c$	$3.97±0.21^c$	$4.39±0.22^c$

Bamboo basket	1.31±0.07[b]	6.04±0.36[b]	12.76±0.60[b]	13.92±0.61[b]
Gunny bags	3.82±0.14[a]	8.18±0.39[a]	16±0.47[a]	18.15±0.59[a]
LSD	0.35***	1.23***	1.48***	1.69***
	Factor B			
Non-dehaulming	1.74±0.50	6.15±0.57	11.41±1.67[a]	12.67±1.88
Dehaulming	1.68±0.46	5.98±0.58	10.41±1.46[b]	11.63±1.65
LSD	0.23NS	0.83NS	0.99*	1.13NS
	Interaction (A×B)			
LSD	0.61NS	2.17NS	2.60NS	2.98NS
CV%	16.04	15.96	10.62	10.93
Grand mean	1.71	6.06	10.91	12.15

Note: The common letter (s) within the column indicate the non-significant difference based on HSD Test at 5% level of significance. Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 '' 1. The ± values represent the standard error of the mean.

4. Conclusion

Recorded parameters such as rotting, sprouting, final weight loss and greening at 20, 40, 60 and 80days were significantly influenced due to the different storage conditions. The superiority of rotting was recorded in gunny bags whereas the minimum rotting was observed in cold storage. Similarly, maximum sprouting was observed in bamboo baskets and minimum sprouting was observed in cold storage. The maximum final weight loss was observed in bamboo basket followed by minimum final weight loss in cold storage. The superiority in greening was observed in gunny bags whereas minimum greening was observed in cold storage. Non-dehaulmed potatoes showed maximum loss in observed parameters whereas dehaulmed potatoes showed minimum loss.

The interaction effect of dehaulming and non-dehaulming with different storage conditions had significant effect in rotting at 20days and in sprouting at 40days. The interaction effect of final weight loss and greening at 20, 40, 60 and 80days was not found significant with the different storage conditions.

On the basis of result obtained from the study, dehaulmed potato stored in different storage conditions (Cold storage, Bamboo basket and Gunny bags) is best for minimum rotting, sprouting, final weight loss and greening percentage. Among all the storage conditions used, best result was obtained in cold storage with minimum storage loss. The farmers are suggested to use dehaulmed potatoes with the storage under cold store. As the potato was stored in 10-12 degree Celsius, there was no sweetness in the cold stored potatoes so preferred by the consumers for table purpose. Therefore, it is suggested to conduct similar research in different location using other varieties along with dehaulming practices.

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