

Evaluation of varietal differences on storage behavior and quality of potato tubers in the ambient condition

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SUMMARY : Ten potato varieties / hybrids were tested for their storability and quality at ambient conditions. About 1 kg of sound tubers of each variety/ hybrid was stored in gunny bags (potato bags) at ambient temperature and there were 3 replications. For different varieties, the total weight loss of tubers varied from 16.01 to 28.29 per cent during 90 days of storage and overall hybrid Atlantic showed good storability.

Key Words : Varieties, Gunny bags, Hybrid, Weight loss

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Potato is an important tuber crop. Stored potatoes deteriorate in quality due to number of reasons. This includes weight loss, sprouting and rotting of tubers. Such deterioration is pronounced when storage is done at relatively temperature. Hence, identification of genotypes with good keeping quality for few months will be of great utility.

Singh and Raghav (1999) found that Kufri Bahar followed by JX-108 showed superiority and Kufri Jawahar showed poor shelf life among the 12 cultivars evaluated for their keeping quality for a period of 120 days at room temperature.

Naik and Basavaraja (1999) evaluated 27 potato genotypes for their storability under ambient condition during October to February in Dharwad and reported that least physiological loss in weight was observed in MS/89-60 (17%) and maximum in JX-23 (44%). Least per cent sprouting was recorded in JX-108 (42.5%) followed by Kufri Jyoti (60.71%) and Kufri Jawahar

(67.4%) after four months of storage.

Kaul and Mehta (1993) compared the keeping quality of some advanced potato hybrids with Kufri Chandramukhi at room temperature. Total loss ranged between 22.0 to 39.2 per cent with minimum values in MS/78-96 (22%) and MS/79-10 (23.8%) that was comparable to Kufri Chandramukhi (23.2%). Maximum total loss was recorded in hybrids JI-5857 (Kufri Sutlej), IN-1758, JI-1857 and JH-222 (Kufri Jawahar). Sprouting percentage and sprout weight were lowest in MS/78-46 and MS/79-10.

Among the varieties used in study by Singh *et al.* (1999), only Kufri Chipsona-1 and Kufri Chipsona-2 gave low reducing sugars (below 150 mg/100 g fresh weight). Kufri Lalima showed maximum content of non-reducing sugars (10.05%) and Kufri Alankar (0.05%) accumulated minimum amounts of non-reducing sugars. Total sugars ranged from 0.59 per cent on fresh weight basis among different varieties.

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EXPERIMENTAL METHODS

The potato varieties/ cultivars selected for varietal trials storage study were obtained from ARS, Madenur which were grown in the experimental plots of All India Coordinated Research Project on Potato. Ten varieties/ hybrids of potato tubers namely, KCH-1, KCH-2, KCH-3, Kufri Surya, Kufri Jyoti, Atlantic, MP/98-71, MP/98-172, MP/99-322 and MP/99-406 were

stored (at ambient conditions of ARS, Madenur for 90 days) in gunny bags. About 1 kg of sound tubers of each variety/ hybrid were stored in 3 replications. Periodically at 15 days interval observations were made for physiological loss in weight (%), weight loss due to rotting (%), total tuber storage loss (%) and sprouting percentage. During storage study, at the beginning and end of the storage, the potato tubers were subjected to biochemical quality analysis in terms of dry matter content, starch content, reducing sugar, total sugar and phenol content.

EXPERIMENTAL FINDINGS AND ANALYSIS

The results of the present study as well as relevant discussions have been presented under following sub heads:

Varietal effect of potato on storage behavior:

Physiological loss in weight:

There was a gradual increase in cumulative physiological loss in weight of potato tubers of all genotypes with increase in storage period and it is given in Fig. 1. Among the cultivars studied, after 15 days of storage, KCH-1 (11.67 %) and Atlantic (12.89%) recorded lowest per cent of PLW. Whereas at 45 days of storage, genotypes KCH 3 (16.78%) and K.Surya (17.25%) had minimum physiological loss in weight. However, cumulative PLW (%) was higher in K.Surya (26.63%) at 90 days of storage. Weight loss during storage is mainly due to physiological process like transpiration, respiration and due to rotting by decay causing organisms. In general, the PLW depends on the intrinsic genetic makeup of the potato tubers some appeared to be better storers than the others.

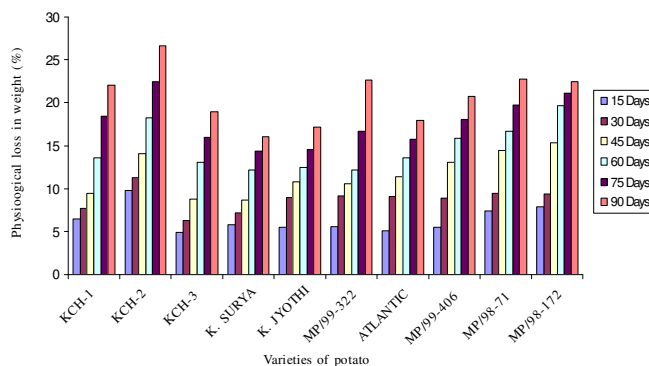


Fig. 1 : Physiological loss of weight of different potato cultivars

Physiological loss in weight of potato tubers is low as long as they remain dormant but, increases due to sprout growth when dormancy is over. The results are in agreement with the results obtained by Mangal *et al.* (1999) and Naik and Basavaraja (1999). Further, study conducted by Kang and Jai Gopal (1993), the genotypes Kufri Lalima, Kufri Lauvakar and JF-5106 showed less weight loss (below 30%) whereas, JI-5857 (Kufri Sutlej) recorded highest weight loss (52.2%) after 140

days of storage.

Tuber loss due to rotting:

Among 10 potato varieties/hybrids tested, rotting was found only in four cultivars. Hybrid Atlantic (0.57%) recorded lowest weight loss due to rotting after 15 days of storage. After 90 days, lowest and highest rotting was noticed in Atlantic (2.83%) and MP/99-406 (4.95%). Though there was a general increase in per cent tuber loss due to rotting with increase in storage period, among susceptible varieties, still the rotting recorded in this study appeared to be low. This lower percentage of rotting may be due to varietal characteristics of the cultivars and it has shown in Fig. 2.

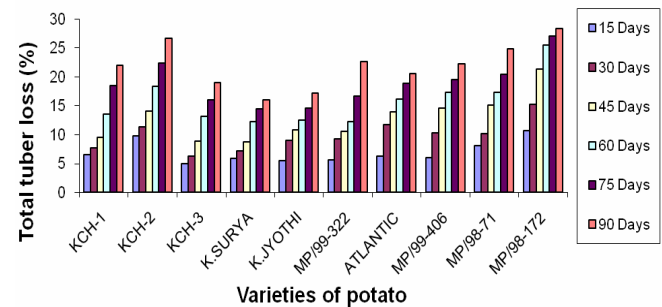


Fig. 2 : Total storage losses of different potato cultivars during storage at ambient conditions

Rotting loss may be due to increased physiological processes like respiration and transpiration of diseased tubers compared to that of healthy tubers. The results of the present study are in agreement with the results obtained by Jaiswal *et al.* (2003). The respiration rates increased as potato tubers were infected with disease and subjected to higher storage temperatures. The combination of disease and higher temperature led to an even higher respiration rates (Fennir, 2002). The weight loss in different genotypes ranged from 8.23 to 9.17 per cent in evaporative cooled potato stores against 3.62 to 4.3 per cent in cold storage after 12 weeks (Kaul and Mehta, 1988).

Sprouting percentage in varieties:

Fig. 3 reveals that up to 15 days of storage, no sprouting was observed in all the tested potato varieties/hybrids. After 45 days, KCH 3 (14.12%) and MP/98-172 (15.72%) showed less sprouting, while higher per cent of sprouting was noticed in K.Surya (39.51%) and MP/98-71 (26.71%). However, after 60 days, the percentage of sprouted tubers was more than 40 per cent in all genotypes and in some cases, it was > 60 per cent. After 90 days, sprouting was between 88-100 per cent in all the tested potato varieties.

Sprouting does not normally occur in freshly harvested potatoes because of the dormancy period and it varies from variety to variety. Enhanced sprouting might be due to variety

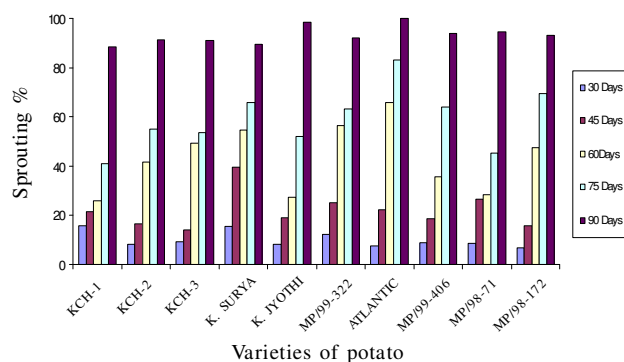


Fig. 3 : Sprouting percentages of different potato cultivars during storage at ambient condition

specific characters. Per cent sprouting was minimum in cultivars JW-160(49.6%) followed by MS/89-60(83.60%) and JW-96(91.82%). However, all other cultivars tested showed 100 per cent sprouting at 90 and 120 days of storage (Kang *et al.*, 2001). Similar results were obtained by Jaiswal *et al.* (2003) and Garg *et al.* (1999).

Biochemical quality changes in different potato cultivars during storage tuber dry matter (%) :

Before storage of tubers, the maximum dry matter content was recorded in the hybrid Atlantic (28.08%) followed by KCH-1 (24.35%) and the lowest dry matter was recorded in the hybrid Kufri Jyoti (18.95%). At the end of 90 days of storage, the maximum dry matter content was recorded in the hybrid Atlantic (20.85%) and the minimum in the hybrid Kufri Jyoti (16.48%) and this is shown in Table 1. There was a general decreasing trend in dry matter content during storage in all the cultivars.

The variation in dry matter accumulation in different cultivars may be due to cell division and elongation in various tissues. The cultivars in which senescence started earlier produced less dry matter (Sharma *et al.*, 1990) with individual leaves declining in photosynthetic activity with senescence. Uppal *et al.* (2001) reported that the heat tolerant genotypes Kufri Chandramukhi, Desiree, A-XI-3, and D-9 had more than

20 per cent tuber dry matter and were considered suitable for chip preparations.

Total starch content (%) :

From Table 1 It reveals that the starch content showed significant differences among the potato varieties studied. Hybrid MP/98-172 (21.23%) and KCH 3 18.66 per cent recorded maximum and minimum starch content before storage. At the end of the storage, MP/98-71(17.28%) and MP/99-406 (13.13%) recorded maximum and minimum starch content, respectively. Significant variations in starch content in different genotypes may be attributed to inherent genetic makeup of the genotype and also the influence of environment. These results are in conformity with those obtained by Ramaswamy and Muthukrishnan (1982), Ashokan and Nair (1983) and Hamilton *et al.* (1985). After storage of tubers also similar trend in starch content was observed.

Reducing sugars:

Table 2 shows that the reducing sugar content was maximum in the hybrid MP/99-406 (223.55 mg/100 g) and lowest in the variety K.Surya (164.57 mg/100 g) before storage. At the end of storage MP/98-172 (422.5 mg/100 g) and KCH 3 (316.59 mg/100 g) recorded maximum and minimum reducing sugars, respectively. Generally, in all the genotypes, there was an increase in reducing sugar content with storage duration.

Variation in reducing sugar content of potato cultivars was reported by Verma *et al.* (1974), Mehta and Kaul (1988), Uppal (1995), Kumar *et al.* (1999) and Uppal *et al.* (2001). Further, many studies have indicated that the reducing sugars of potato tubers increased with storage. This may be due to conversion of starch into sugars. (Kumari and Mukherjee (1986), Uppal and Ezekiel (1999).

Total sugars:

Total sugar content was maximum in the hybrid MP/99-406 (332.80 mg/100 g) and lowest in the variety MP/99-322 (285.0 mg/100g) before storage. At the end of storage, MP/98-

Table 1 : Comparison of tuber dry matter and starch content of potato tubers of different cultivars/hybrids before and after 90 days of storage

Variety	Tuber dry matter (%)		Starch content (%)	
	Before storage	After 90 days of storage	Before storage	After 90 days of storage
MP/98-71	19.91	17.35	20.05	17.28
MP/98-172	24.54	18.70	21.23	16.26
MP/99-322	22.13	17.99	21.06	13.59
MP/99-406	24.3	19.04	19.14	13.13
KCH-1	24.35	18.37	20.32	15.35
KCH-2	22.87	17.38	18.89	13.49
KCH-3	21.29	17.67	18.66	14.53
KUFRI SURYA	20.00	16.54	19.69	14.51
KUFRI JYOTHI	18.95	16.48	19.53	13.41
ATLANTIC	28.08	20.85	18.85	13.45

Table 2 : Comparison of total and reducing sugars in potato tubers of different cultivars/hybrids before and after storage

Variety	Reducing sugars (mg/100 g)		Total sugars (mg/100 g)	
	Before storage	After 90 days of storage	Before storage	After 90 days of storage
MP/98-71	211.6	372.85	316.95	619.85
MP/98-172	219.45	422.50	324.95	651.85
MP/99-322	199.6	645.02	285.00	603.95
MP/99-406	223.55	356.35	332.80	633.1
KCH-1	208.3	343.40	324.35	594.9
KCH-2	210.5	347.07	329.05	589.6
KCH-3	167.87	316.59	297.20	598.2
KUFRI SURYA	164.57	333.24	309.35	608.7
KUFRI JYOTHI	180.25	348.94	294.75	613.1
ATLANTIC	185.80	359.87	313.55	646.25

172 (651.85 mg/100 g) recorded maximum followed by ATLANTIC (646.25 mg/100 g) total sugar content (Table 2).

As stated earlier, total sugars of potato tubers varied with genotypes (Singh *et al.*, 1999) and during storage, generally the total sugar content increased due to conversion of starch into sugars both reducing and non-reducing type.

Phenol content:

Before storage, maximum phenol content was observed in cultivar Kufri Jyoti (19.26 mg/100 g) followed by Atlantic (15.69 mg/100g) and lowest phenol content was recorded in MP/99-406 (7.45 mg/100 g). At the end of 90 days of storage, Kufri Jyoti (27.74 mg/100 g) recorded maximum phenol content and lowest was observed in MP/99-406 (12.95 mg/100 g) and it is presented in Table 3.

Table 3 : Phenol content of different varieties/hybrids of potato tubers before and after 90 days of storage

Variety	Phenol content (mg/100 g)	
	Before storage	After 90 days of storage
MP/98-71	12.57	18.83
MP/98-172	8.50	14.95
MP/99-322	11.39	16.44
MP/99-406	7.45	12.95
KCH-1	15.35	23.03
KCH-2	14.69	21.30
KCH-3	11.07	15.73
KUFRI SURYA	12.27	19.99
KUFRI JYOTHI	19.26	27.74
ATLANTIC	15.69	22.46

The phenol content of tubers was reported to vary with variety (Ezekiel *et al.*, 2007) and is produced during wound-healing after harvest (Kumar *et al.*, 1991). The reduction in crude phenol contents during storage was reported by Mehta (2004). The level of phenolic compounds changes according to

temperature and length of storage, it was found highest in tuber stored at 5°C and the lowest at 15.5°C (Linsinska and Leszczynski, 1989).

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