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# EVALUATION OF POTATO GENOTYPES FOR KEEPING QUALITY UNDER AMBIENT CONDITIONS IN NEPAL

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**ABSTRACT: An experiment on keeping quality of potato under non-refrigerated storage conditions was conducted during 2011 for 120 days under dark room at ambient temperature (25.8 ± 1.2°C) and relative humidity (86.1%) to study the performance of seven potato genotypes for good storability. The results revealed that the genotypes BSU-PO3, HPS-II/67, PRP 25861.1 and Kufri Chipsona-2 were found suitable only for 45 to 60 days storage, while the genotypes Yagana and L-235.4 could be successfully stored for maximum period up to 120 days with minimum weight loss. The genotypes PRP 25861.1 and BSU-PO3 had higher dry matter percentage and were found superior for processing in to chips.**

**KEYWORDS:** Potato genotypes, keeping quality, ambient temperature, Nepal

## INTRODUCTION

Potato is as an important commercial vegetable and food crop in Nepal. The area, production and productivity of this crop have been increasing steadily over the last two decades. At present, Nepal produces 2.518 million tones of potatoes from about 185 thousand hectares of land with an average productivity of 13.584 t/ha (ABPSD, 2010). In the mid hills of Nepal, potato is mainly planted during January - February and harvested during June - July *i.e.* the beginning of hot and rainy season. At this time the market price is low and farmers are compelled to sell their harvest at minimum price, whereas the market price increases rapidly and reaches maximum during October-November (NPDP, 2010), but storing of potato for this period under on-farm conditions causes great losses due to the sprouting and rotting. The storage losses of potato has been estimated about 10-40% under on-farm storage (Mehta and Ezekiel, 2010).

Different varieties of potatoes have been evaluated and recommended for long term storability and good processing qualities for chips making in India (Mehta, 2006 and Mehta *et al.*, 2006). The Indian processing potato varieties, like Kufri Chipsona-1, Kufri Chipsona-2, Kufri Jyoti, Kufri Lauvkar and Kufri Chandramukhi have not been evaluated for their long term storability in Nepal. Therefore, this experiment was conducted to study the keeping quality of potatoes grown in mid hills of Nepal.

## MATERIALS AND METHODS

Nine potato genotypes (two Indian varieties; Kufri Chipsona-2 and Kufri Jyoti; four CIP lines HPS-II/67, HPS 7/67, L-235.4 and Khumal Seto-1; one PRP (Potato Research Program) cross line PRP 25861.1; one American line Yagana and one Philippine line BSU-$PO_3$ were planted at Hattiban Research Farm Khumaltar, Nepal (1340 masl) during the summer season of 2010 in clayey soil with

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the pH below 6.0. The crop was harvested at 120 days after planting. After harvesting, potato tubers were kept for 15 days in room temperature for wound healing and curing of skin. Un-damaged and apparently healthy tubers with more than 60 g weight were selected to study the keeping quality. This experiment was laid out in Complete Randomized Design (CRD) with 3 replications. Five kg of healthy tubers of each genotype were kept in plastic trays (two third portion of tray remaining empty) and placed at ambient room temperature (25.8 ± 1.2°C and 86.1% RH) under dark condition from 16 June to 14 October 2011 (**Fig. 1**). Kufri Jyoti a recommended variety suitable for the chipping industry in India (Rana, 2011) and commonly grown in Nepal was taken as control.

Temperatures were recorded at half an hour's interval by data logger (Hobo). For calculation of relative humidity, temperature was recorded daily at 9.30 AM with dry-wet bulb thermometer and relative humidity was calculated by depression in wet bulb temperature as compared to dry bulb. A tuber was considered sprouted when it had at least one sprout measuring ≥0.2 cm. Dry matter was determined by chopping and mixing of tubers in to small pieces and oven drying 100 g sample at 80°C for 6 hours and then at 65°C till constant weight. Reducing sugars was determined by using di-nitrosalicyclic colorimetric method (Miller, 1959) by recording the absorbance in spectrophotometer at 575 nm. The observed data on different parameters were analyzed by using Gen-stat 532-2 programme and DMRT of MSTAT C was used for mean comparison.

## RESULTS AND DISCUSSION

### Weight loss percentage

Significant variations were observed among the different genotypes for physiological weight loss percentage (PWLP) and total weight loss percentage (TWLP) throughout the storage period (**Table 1**). At 120 day of storage, Yagana and L-253.4 had the minimum weight loss of 7.88% and 8.30% respectively, followed by Kufri Jyoti (9.90%) and Khumal Seto-1 (10.04%). However, the highest (24.19%) total weight loss percentage was observed on genotype BSU-PO3. During initial 60 days of the storage, rotting of few tubers were noticed on Kufri Chipsona-2, BSU-PO3, HPS-II/67, while no rotting was observed on HPS 7/67, PRP25861.1, Yagana and L-235.4. RWLP was negligible in all the genotypes after 60 days storage.

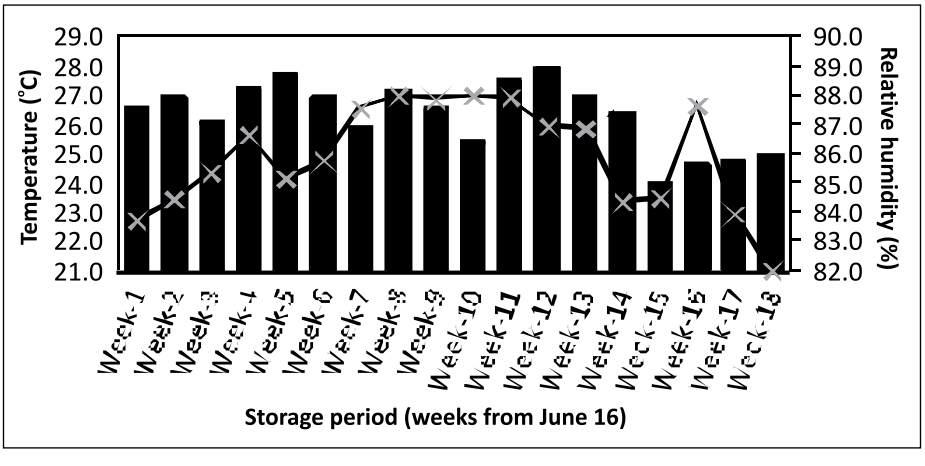


*Fig. 1. Weekly mean temperature and relative humidity of storage room from 16 June to 14 October, 2011.*

**Table 1. Effect of potato genotypes on weight loss percentage under dark at ambient temperature (25.8 ± 1.2°C & 86.1% RH), Khumaltar, 2011.**

| Genotypes | Days after storage | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 60 | | | 90 | | | 120 | | |
| | PWLP | RWLP | TWLP | PWLP | RWLP | TWLP | PWLP | RWLP | TWLP |
| 1. Kufri Chipsona-2 | 7.04*ab* | 2.82 *a* | 9.86*ab* | 14.43*ab* | 0.53 | 14.96*ab* | 19.83*ab* | 0.00 | 19.83 *ab* |
| 2. HPS-7/67 | 5.88*ab* | 0.00 *b* | 5.88 *cd* | 10.64*bc* | 0.00 | 10.64 *bc* | 16.02 *b* | 0.59 | 16.61 *b* |
| 3. PRP 25861.1 | 3.32 *b* | 0.00 *b* | 3.32 *d* | 7.19*cd* | 0.00 | 7.19 *cd* | 15.36 *bc* | 0.00 | 15.36 *bc* |
| 4. Yagana | 3.31 *b* | 0.00 *b* | 3.31 *d* | 4.65*d* | 0.47 | 5.12 *d* | 7.88 *d* | 0.00 | 7.88 *d* |
| 5. BSU PO3 | 10.42*a* | 2.37 *a* | 12.80*a* | 17.6 *a* | 0.88 | 18.55 *a* | 24.19 *a* | 0.00 | 24.19 *a* |
| 6. L-235.4 | 3.45 *b* | 0.00 *b* | 3.45 *d* | 5.57*d* | 0.33 | 5.90 *d* | 8.30 *d* | 0.00 | 8.30 *d* |
| 7. Khumal Seto-1 | 3.98 *b* | 0.00 *b* | 3.98 *d* | 4.29*ab* | 0.00 | 4.29 *d* | 10.04 *cd* | 0.00 | 10.04 *cd* |
| 8. HPS-II/67 | 7.46*ab* | 1.03 *ab* | 8.49 *bc* | 14.04ab | 0.49 | 14.53*ab* | 21.63*ab* | 0.00 | 21.63 *ab* |
| 9. Kufri Jyoti | 5.14 *b* | 0.52 *b* | 5.66*bd* | 7.38*cd* | 0.00 | 7.38 *cd* | 9.90 *cd* | 0.00 | 9.90 *cd* |
| F-value | 0.033 | 0.007 | <0.001 | <0.001 | 0.571 | <0.001 | <0.001 | 0.469 | <0.001 |
| LSD (0.05) | 4.372 | 1.651 | 3.710 | 4.539 | - | 4.510 | 6.184 | - | 6.234 |

## Sprouting percentage

The sprouting of potato in the storage started after 30 days on genotype HPS 7/67 (18.9%). At 45 days, sprouting was observed on HPS-II/67. At 60 days, except L-235.4 and Kufri Jyoti, all other genotypes were sprouted. The highest sprouting percentage was recorded on PRP25861.1 (84.7%) followed by HPS-7/67 (63.9%), Khumal Seto-1 (45.0%), HPS-II/67 (38.0%), Kufri Chipsona-2 (17.4%) and BSU-PO3 (6.6%).

At 90 days after storage, the genotypes were categorized into 3 groups on the basis of sprouting. The genotypes PRP 25861.1, Khumal Seto-1, HPS- 7/67, Kufri Chipsona-2 and HPS-II/67 were placed on the first group (83.3-100% sprouting), BSU-PO3, L-235.4 and Yagana on the second group (52.4-64.1% sprouting), and the Kufri Jyoti on the third group (20.1% sprouting) (**Fig. 2**). At the end of storage period (120 days), Kufri Jyoti had only 68.43% sprouting while it was 100% in all the genotypes. The minimum sprouting percentage on Kufri Jyoti could be due to its genotypic characters associated with its skin thickness.

## Sprout number and weight

The genotypes differed significantly on sprout number and weight after 120 days storage **(Table 2)**. The highest number of spouts per tuber was observed on genotype PRP 25861.1 (3.90). Kufri Jyoti showed significantly the lowest number of sprout per tuber (1.37) and it was at par with Yagana (1.47). Similarly, the sprout weight also differed significantly among the genotypes.

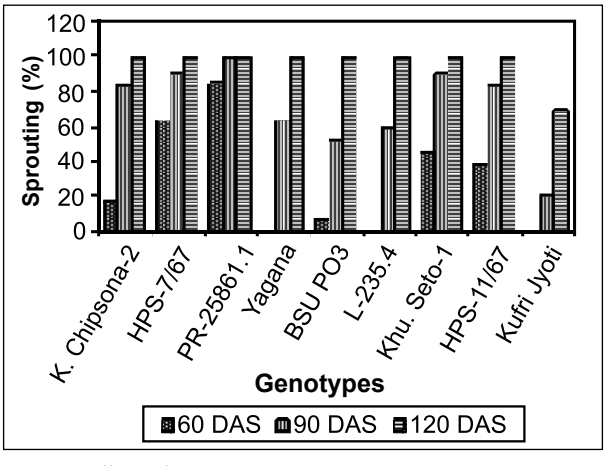


*Fig. 2. Effect of potato genotypes on sprouting percentage at different days on non-refrigerated storage at Khumaltar, 2011.*

**Table 2. Effect of potato genotypes on sprout number and sprout weight at 120 days after storage at ambient temperature (25.8 ± 1.2°C & 86.1% RH), Khumaltar, 2011.**

| Genotypes | Sprout (#./tuber) | Sprout weight (g/kg tubers) |
|---|---|---|
| 1. Kufri Chipsona-2 | 1.93 bc | 12.93 bc |
| 2. HPS-7/67 | 2.10 b | 27.87 a |
| 3. PRP 25861.1 | 3.90 a | 28.70 a |
| 4. Yagana | 1.47 cd | 10.17 c |
| 5. BSU PO3 | 1.87 bc | 15.30 bc |
| 6. L-235.4 | 1.83 bc | 9.03 c |
| 7. Khumal Seto-1 | 1.90 bc | 14.40 bc |
| 8. HPS-II/67 | 2.00 b | 20.30 ab |
| 9. Kufri Jyoti | 1.37 d | 8.67 c |
| F-value | <0.001 | <0.001 |
| LSD (0.05) | 0.4189 | 8.206 |

The highest sprout weight (28.70 g/kg tuber) was recorded on PRP 25861.1 and it was at par with HPS 7/67 (27.87 g/kg tuber) and genotype HPS-II/67 (20.30 g/kg tubers), whereas the lowest sprout weight (8.67 g// kg tuber) was recorded on Kufri Jyoti and it was at par with L 235.4 (9.03 g/kg tuber) and Yagana (10.17 g/kg tuber).

## Dry matter percentage

The dry matter content varied significantly among the genotypes before and after 120 days dark storage. PRP 25861.1 had the highest dry matter before storage (19.92%); where as the lowest dry matter was recorded on Kufri Jyoti (15.80%) **(Table 3)**. After 120 days storage, there was mean increment of 3.78% dry matter. The increment of dry matter after storage in all treatment could be due to loss of water from tubers through respiration and evaporation. Low dry matter content on Kufri Jyoti and Kufri Chipsosa-2 before and after storage than India could be due to difference of environment and growing conditions. The increased in dry matter after storage was also reported in India when potato was stored in heap and pits at 25-35°C for 135 days (Ezekiel *et al.*, 2004).

## Reducing sugars

The reducing sugar content up to 150 mg/100 gram fresh weight is considered good and up to 250 g/100 g fresh weight is considered acceptable for chips making. In this experiment, the reducing sugars showed

**Table 3. Effect of potato genotypes on dry matter, specific gravity and reducing sugars content before and after 120 days of storage at ambient temperature (25.8 ± 1.2°C & 86.1% RH), Khumaltar, 2011.**

| Genotypes | DM (%) | | | RS (mg/100 g fresh wt) | | |
|---|---|---|---|---|---|---|
| | BS* | AS** | Increased in DM after storage | BS* | AS** | Increased in RS after storage |
| 1. Kufri Chipsona-2 | 16.50 *ab* | 16.90 *de* | 2.42 | 21.67 *bcd* | 44.0 | 103.00 |
| 2. HPS-7/67 | 17.34 *ab* | 18.40 *bc* | 6.11 | 23.67 *bc* | 50.3 | 112.50 |
| 3. PRP 25861.1 | 19.92 *a* | 20.63 *a* | 3.56 | 25.33 *b* | 50.0 | 97.39 |
| 4. Yagana | 17.14 *ab* | 17.80 *cd* | 3.65 | 17.0 *d* | 52.0 | 205.88 |
| 5. BSU PO3 | 18.69 *ab* | 19.40 *b* | 3.79 | 18.33 *cd* | 42.7 | 132.95 |
| 6. L-235.4 | 17.52 *ab* | 18.07 *c* | 3.14 | 25.33 *b* | 56.3 | 122.26 |
| 7. Khumal Seto-1 | 17.96 *ab* | 18.50 *bc* | 3.60 | 24.33 *b* | 57.0 | 134.26 |
| 8. HPS-II/67 | 17.19 *ab* | 17.73 *cd* | 3.14 | 31.00 *a* | 56.7 | 82.90 |
| 9. Kufri Jyoti | 15.80 *b* | 16.53 *e* | 4.62 | 22.00 *bcd* | 35.3 | 66.45 |
| F-value | <0.001 | <0.001 | | <0.001 | 0.094 | |
| LSD (0.05) | 3.416 | 0.971 | | 3.079 | - | |

*Before storage and **After storage.

significant and non-significant differences among genotypes before and after 120 days storage, respectively **(Table 3)**. There was 131.17% mean increment of reducing sugars after 120 days storage. The increment of reducing sugars after storage could be due to ageing and sprouting of tubers.

## CONCLUSIONS

From the study, it can be concluded that the genotype PRP 28861.1 with the highest dry matter content was suitable for only 45-60 days storage in ambient room temperature (25.8 ± 1.2°C and 86.1% RH). This genotype had significantly early sprouting and reaching > 50% sprouting within 45 days after storage. Genotypes BSU-PO3, HPS-II/67, Kufri Chipsona -2 (North Indian plains processing variety) and HPS-7/67 were suitable for 75 days storage in ambient room temperature (16 June to 29 August). The genotypes Yagana and L-235 could be successfully stored in ambient room temperature for maximum period of up to 120 days (16 June to 14 Oct.) with minimum total weight loss of 7.88 and 8.30% and rotting weight loss of 0.33 and 1.03%, respectively.

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