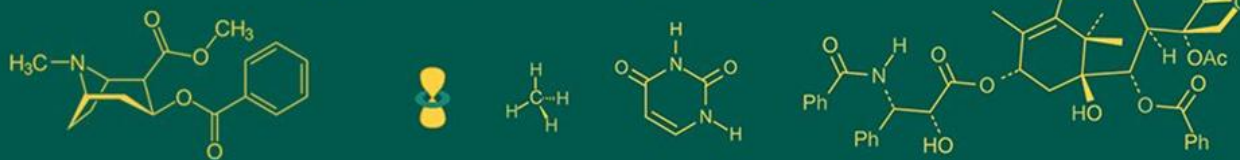


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All authors' names and affiliations
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Evaluation of early maturing hybrids/varieties for Postharvest behaviour of potato tubers under ambient storage conditions in North Central India

Hemant Kumar Meena, Murlidhar J Sadawarti, KV Singh, Deepanshi Deora, Vinod Kumar, Nilesh Ninama, Tanuja Buckseth, Subhash Katore, Rajendra Kumar Samadhiya, SP Singh, Dharmendra Verma, Ramawatar Choudhary, Astha, Abhishek Yadav and Umesh Patle

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Abstract

To study the post-harvest behaviour of early maturing hybrids/varieties of potato under ambient storage conditions in North Central India, a field experiment was demonstrated at experimental area of ICAR, Central Potato Research Station (CPRS), Gwalior, Madhya Pradesh, during two consecutive *Rabi* seasons (2023-24 and 2024-25). The experiment was laid out in Randomized Block Design, with 3 replications comprised of 11 treatments 5 hybrids (P-68, P-79, P-89, P-97, P-105) and 6 varieties (Kufri Khyati-C-14, Kufri Pukhraj-C-17, Kufri Bahar -C-6, Kufri Badshah-C-5, Kufri Mohan-P-1, Kufri Ganga-P-9) and 33 total experimental plots. On the basis of pool data of storage behaviour of tubers, significantly highest physiological loss in weight was observed at 15 DOS (3.94%) and 30 DOS (7.17%) in T₉-C-5, at 45 DOS (11.88%) in T₁-P-68 and at 60 DOS (21.50%) in T₁₀-P-1. At 60 DOS, significantly maximum rotting of tuber number (4.14) was found in T₇-C-17. Similarly, at 60 DOS significantly highest rotting of tuber weight (269.02 g) was observed in T₇-C-17.

Keywords: Physiological loss, storage, tubers, rotting, post-harvest behaviour

1. Introduction

Potato (*Solanum tuberosum* L.) is the king of vegetables, belongs to the family Solanaceae. In terms of fresh produce, potato is the fourth largest crop after rice, wheat and maize (Thamburaj and Singh, 2016) [14]. It is a low-cost energy source of the human diet. It is a rich source of starch, vitamins viz. thiamine, riboflavin, niacin, pyridoxine and ascorbic acid and minerals. Potato is most widely grown vegetable crop in the country with a share of 28 percent (Rana, 2014) [10].

Potato production in India has been rising steadily, driven by increasing domestic demand for both table and processing purposes, supported by the adoption of improved varieties and modern cultivation practices. In India, during 2023–24, the crop covered nearly 2.25 million ha, producing about 60.14 million t with an average productivity of 26.7 t ha⁻¹ (Anonymous, 2023a; Anonymous, 2024) [1, 2, 3].

The major potato-producing states are Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab, Haryana, Assam, Jharkhand and Chhattisgarh (Anonymous, 2024) [3].

In Madhya Pradesh, the crop occupies about 170 thousand ha, producing approximately 3.9 million t with an average productivity of 23.0 t ha⁻¹ (Anonymous, 2023b) [2]. Early maturing potato varieties which are ready to harvest in about 60-75 days, provide much needed food before grains are ready. These early maturing features facilitate the potato to incorporate into cropping system and also fit well in sequential cropping of paddy-potato-wheat during fallow periods, due to its high yield under early (75 days) and very early (60 days) harvest. Storage is an important aspect in potato production and utilization cycle. Semi perishable nature of the potato coupled with poor prices during harvesting in the region and the need to store potato for seed as well as home consumption have led to heavy dependence of farmers on traditional storage structures for potatoes.

Corresponding Author:
Hemant Kumar Meena
 Ph.D. (Research Scholar)
 Vegetable Science, Department of
 Vegetable Science, College of
 Agriculture, Rajmata Vijayaraje
 Scindia Krishi Vishwa Vidyalyaya,
 Gwalior (474002) Madhya Pradesh,
 India

These traditional storage structures in their region are utilized for short as well as long term storage needs. (Sha *et al.*, 2009). Farmers of Madhya Pradesh and Gujarat generally prefer to store potato in heaps or pits for short term for getting remunerative prize (Sadawarti *et al.*, 2020) ^[11]. So, developing early potato hybrids or varieties is most important in current situation (Kawar *et al.*, 2018) ^[6].

2. Materials and Methods

The present experiment was laid out in the field of the experimental area of ICAR, Central Potato Research Station (CPRS), Gwalior, Madhya Pradesh, during two consecutive Rabi seasons (2023-24 and 2024-25) at storage house. The experiment was laid out in Randomized Block Design, with 3 replications comprised of 11 treatments (hybrid 5, varieties 6) and 33 total experimental plots. The topography of the experimental site was almost uniform, with adequate surface drainage. The experimental field was silty clay loam to silt loam with good drainage and lies 206 meters above sea mean level under subtropical climate and located at 26°13' N latitude and 78°14' E longitude. The area enjoying with extreme summer and

winter (44.4 °C in summer and minimum 3.9°C in the winter). The annual rainfall ranges between 700 and 750 mm, most of which is received from the end of June to the end of September, with few showers in the winter months. At physiological maturity, uniform and healthy tubers were harvested from each plot, air-dried after cleaning under the shade and stored in plastic crates under ambient conditions i.e. 25–30°C of temperature and 70–80% of relative humidity. Healthy tubers selected per treatment, physiological loss in weight (PLW%) was recorded by weighing of stored tubers at different intervals, all visibly rotted, decayed and infected tubers were separated, counted and weighed as rotting number and weight of tubers

$$\text{PLW (\%)} = \frac{[(\text{Initial weight} - \text{Weight at observation}) / \text{Initial weight}] \times 100}{}$$

The observations data were collected from the standard procedure and were statistically analyzed and carry out ANOVA- test to analyze the significance of differences among the treatments. The ANOVA- test was carried out as per suggested by Panse and Sukhatme (2000) ^[9].

Table 1: Treatments comprised 5 hybrids and 6 controls

Symbol		Treatments
T ₁	:	P-68
T ₂	:	P-79
T ₃	:	P-89
T ₄	:	P-97
T ₅	:	P-105
T ₆	:	Kufri Khyati (C-14)
T ₇	:	Kufri Pukhraj (C-17)
T ₈	:	Kufri Bahar (C-6)
T ₉	:	Kufri Badshah (C-5)
T ₁₀	:	Kufri Mohan (P-1)
T ₁₁	:	Kufri Ganga (P-9)

3. Results and discussion

At 15 DOS, PLW was obtained significantly highest (3.94%) in T₉-C-5, statistically at par with T₆-C-14 and T₄-P-97 (3.70% and 3.68%, respectively). Whereas, T₇-C-17 showed the lowest (3.07%) PLW at this stage. At 30 DOS, PLW was obtained significantly highest (7.17%) in T₉-C-5, statistically at par with T₄-P-97, T₆-C-14 and T₈-C-6 (6.87%, 6.72% and 6.66%) respectively. Whereas, the lowest (5.47%) PLW was obtained in T₇-C-17. These early differences across treatments likely stem from genotype-driven variation in respiration rate, tuber moisture content and periderm traits under ambient storage. This pattern aligns with Brar and Rana (2016) ^[4, 10], who reported significant varietal differences in PLW under room-temperature storage, with certain cultivars showing reduced weight loss owing to greater storage stability.

By 45 days, significantly highest (11.88%) PLW was obtained in T₁-P-68, statistically at par with T₁₀-P-1, T₂-P-79, T₉-C-5 and T₁₁-P-9 (11.71%, 11.49%, 11.21% and 11.21%) respectively. Whereas, lowest (10.25%) PLW was obtained in T₃-P-89. At 60 days, significantly highest (21.50%) PLW was obtained in T₁₀-P-1, statistically at par with T₇-C-17 (21.40%). Whereas, the lowest (20.25%) PLW was obtained in T₆-C-14. This progressive weight loss reflects the combined effect of moisture escaping through the tuber skin and carbohydrate reserves being consumed *via* respiration both ongoing processes shaped by genotype-specific periderm structure, surface-area-to-volume ratio and baseline respiration rate. This upward trend through 60 days mirrors findings by Brar and Rana (2016) ^[4, 10], who also documented substantial varietal differences in PLW over extended storage and is consistent with Salil *et al.* (2005) ^[13], who linked progressive PLW increases to respiration and

transpiration losses, especially in unrefrigerated storage. Overall, tuber rotting stayed minimal through 45 days but rose noticeably by 60 days under ambient conditions. Pooled data showed Kufri Pukhraj and P-680 with notably higher rotting at 60 days, while P-68 had the least, pointing to clear genotypic differences in storage resilience results consistent with Deora *et al.* (2025) ^[6] and Mishra *et al.* (2023) ^[8].

For number of rotted tubers at 60 days, T₇-C-17 obtained significantly highest (4.14) rotted tubers, while T₅-P-105 obtained lowest (1.58) rotted tubers. Rotting during extended ambient storage largely results from microbial attack mainly opportunistic fungi and bacteria that exploit wounds, lenticels or weakened tissue, with susceptibility varying by genotype. The rise in rotting later in storage may relate to dormancy breaking, higher respiration, moisture depletion and greater vulnerability to infection. This matches observations by Kumar *et al.* (2023) ^[7], who also found rotting losses climbing with longer ambient storage.

at 60 days, weight of rotted tubers showed significant variation among different treatments. The pooled data indicated that significantly highest (269.02 g) weight of rotted tubers was recorded in T₇ - C-17, statistically at par with T₁₀ - P-1 (256.11 g) and T₈ - C-6 (254.10 g). Whereas lowest (90.88 g) weight of rotted tubers was obtained in T₅ - P-105. Measuring rotting by weight gives a more economically relevant picture of loss, since it captures both how many tubers were infected and how large they were better reflecting the actual share of stored biomass lost to decay. Increased sprouting later in storage may result from dormancy ending and heightened physiological activity under ambient conditions, consistent with Kumar *et al.* (2023) ^[7].

Table 2: Physiological loss in weight (PLW%) at 15, 30, 45 and 60 days of storage as influenced by different hybrids and varieties

Treatments	PLW% at 15 days of storage			PLW% at 30 days of storage			PLW% at 45 days of storage			PLW% at 60 days of storage		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
P-68	3.36	3.46	3.41	6.12	6.13	6.12	12.01	11.76	11.88	19.77	21.09	20.43
P-79	3.38	3.83	3.60	6.14	6.18	6.16	11.49	11.49	11.49	21.71	20.96	21.34
P-89	3.40	3.56	3.48	6.36	6.26	6.31	10.01	10.48	10.25	22.04	20.53	21.29
P-97	3.74	3.61	3.68	6.76	6.98	6.87	10.43	10.87	10.65	20.81	20.92	20.87
P-105	3.23	3.15	3.19	5.25	5.75	5.50	10.25	10.81	10.53	21.64	20.86	21.25
Kufri Khyati (C-14)	3.68	3.71	3.70	6.71	6.72	6.72	11.14	10.96	11.05	19.47	21.02	20.25
Kufri Pukhraj (C-17)	3.09	3.04	3.07	5.23	5.70	5.47	10.03	10.53	10.28	22.22	20.58	21.40
Kufri Bahar (C-6)	3.45	3.24	3.35	6.60	6.71	6.66	10.90	10.91	10.90	20.40	21.94	21.17
Kufri Badshah (C-5)	3.95	3.93	3.94	7.23	7.11	7.17	11.38	11.04	11.21	21.21	21.55	21.38
Kufri Mohan (P-1)	3.32	3.28	3.30	5.47	6.03	5.75	11.54	11.89	11.71	21.18	21.81	21.50
Kufri Ganga (P-9)	3.35	3.50	3.42	5.65	6.09	5.87	10.92	11.50	11.21	20.23	21.54	20.89
SEm(±)	0.149	0.149	0.105	0.368	0.305	0.239	0.368	0.295	0.236	0.382	0.293	0.241
CD at 5%	0.440	0.438	0.301	1.085	0.900	0.683	1.085	0.869	0.674	1.128	0.864	0.688

Table 4: Rotting of tuber number and weight under ambient temperature as influenced by different hybrids and varieties

Treatments	Rotting number at 60 days			Rotting weight (g) at 60 days		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
P-68	1.45	2.33	1.89	105.58	150.61	128.09
P-79	2.00	2.67	2.33	131.65	209.99	170.82
P-89	2.67	2.42	2.54	189.90	175.49	182.70
P-97	3.67	2.93	3.30	235.91	230.92	233.41
P-105	1.18	1.97	1.58	67.13	114.63	90.88
K. Khyati(C-14)	2.00	2.18	2.09	133.76	129.72	131.74
K. Pukhraj(C-17)	4.33	3.94	4.14	256.00	282.04	269.02
K. Bahar (C-6)	3.33	3.67	3.50	226.07	282.12	254.10
K. Badshah(C-5)	3.33	3.00	3.17	228.66	192.14	210.40
K. Mohan (P-1)	4.13	3.33	3.73	277.07	235.15	256.11
K. Ganga (P-9)	2.37	3.00	2.68	150.26	194.44	172.35
SEm (±)	0.182	0.176	0.127	6.379	10.586	6.179
CD at 5%	0.537	0.520	0.363	18.815	31.223	17.662

4. Conclusion

On the basis of pool data, it is observed that storage behaviour of tubers, significantly highest physiological loss in weight was observed at 15 DOS (3.94%) and 30 DOS (7.17%) in T₉-C-5, at 45 DOS (11.88%) in T₁-P-68 and at 60 DOS (21.50%) in T₁₀-P-1. At 60 DOS, significantly maximum rotting of tuber number (4.14) was found in T₇-C-17. Similarly, at 60 DOS significantly highest rotting of tuber weight (269.02 g) was observed in T₇-C-17.

5. Competing interests

All the author declares that there is no conflict of interest related to this article.

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All authors' names and affiliations

Hemant Kumar Meena

Ph.D. (Research Scholar) Vegetable Science, Department of Vegetable Science, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Murlidhar J Sadawarti

ICAR-Central Potato Research Institute, Regional Station, Gwalior, Madhya Pradesh, India

KV Singh

Senior Scientist, (Vegetable Science), KVK Lahar, Bhind, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Deepanshi Deora

Ph.D. (Research Scholar) Vegetable Science, Department of Vegetable Science, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Vinod Kumar

ICAR-Central Potato Research Institute, Shimla, Himachal Pradesh, India

Nilesh Ninama

Ph.D. (Research Scholar) Vegetable Science, Department of Vegetable Science, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Tanuja Buckseth

ICAR-Central Potato Research Institute, Shimla, HP, India

Subhash Katare

ICAR-Central Potato Research Institute, Regional Station, Gwalior, Madhya Pradesh, India

Rajendra Kumar Samadhiya

ICAR-Central Potato Research Institute, Regional Station, Gwalior, Madhya Pradesh, India

SP Singh

ICAR-Central Potato Research Institute, Regional Station, Patna, Bihar, India

Dharmendra Verma

ICAR-Central Potato Research Institute, Shimla Himachal Pradesh, India

Ramawatar Choudhary

Ph.D. (Research Scholar) Department of Fruit Science, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Astha

Ph.D. (Research Scholar) Department of Fruit Science, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Abhishek Yadav

Ph.D. (Research Scholar) Vegetable Science, Department of Vegetable Science, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Umesh Patle

Ph.D. (Research Scholar) Agronomy, Department of Agronomy, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India