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EVALUATION OF POST-HARVEST STORAGE TECHNIQUES OF POTATO ADOPTED BY FARMERS IN BAGLUNG DISTRICT, NEPAL

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ABSTRACT
The survey aimed to investigate different storage methods, identify the most preferred ones, study the socio-demographic status of farmers, and understand the challenges they face during storage conditions. A total of 94 farmers were selected using simple random sampling technique for a survey conducted with a semi-structured questionnaire. Data collected through HH interviews and direct observations were analyzed with SPSS and Microsoft Excel. For most respondents, agriculture was the main source of income, with potato serving as the vital staple food in this region. The absence of research and extension activities caused farmers to rely on traditional cultivation methods, which led to lower yields and productivity. Their knowledge of potato storage techniques was limited to traditional methods such as bamboo baskets (*Doko and Dalo*), bamboo containers (*Bhakari*), room storage, sacks, and wooden baskets. Fourteen respondents reported post-harvest losses exceeding 20% of production. Farmers showed minimal awareness of modern storage solutions like rustic stores for seeds and cold storage for ware potatoes. Farmers showed minimal awareness of modern storage solutions like rustic stores for seeds and cold storage for ware potatoes. Diseases and pests, including PTM, white grubs, red ants, blight, wilt, and bacterial rots, affected crop quality during storage. Many farmers employed multiple storage methods, with 70% respondents using more than one technique. Seed storage practices were similar to those used for ware potatoes, with only 6% utilizing rustic storage. Additionally, issues such as sprouting, shrinking, greening, and insect or rodent infestations posed significant challenges. It is crucial to implement simple and cost-effective technological interventions to reduce storage losses effectively.

KEY WORDS
Potato, storage, diseases, pests.

Solanum tuberosum is the third most important food crop globally, after rice and wheat with China being the top producer followed by India (Tiwari et al., 2022). Potato was introduced in Nepal in 1793, becoming economically significant in the 19th century (Gairhe et al., 2017). Widely recognized as a high-value crop, potatoes are among the most commonly cultivated vegetables in the Terai region and a staple food at mid and high hills of Nepal. They are grown widely from the southern Terai at altitudes as low as 100 masl to the northern mountains as high as 4,000 masl (Oli & Devi, 2022). Potatoes are a cheap raw material that has widened its scope which helps to uplift the economic condition of smallholder farmers (Bajracharya & Sapkota, 2017). Potato is cultivated as a subsistence crop which is the best potential for yield increment and consists of high starch (16.1/100 g), protein (2.1/100 g), vitamin C (17.1 mg/100 g), potassium (443 mg/100 g) and essential amino acids (Bajracharya & Sapkota, 2017). Potato is used for food, animal feed, industrial purposes, and seed tuber production globally, with varieties grown for fresh markets and processing into products like crisps and French fries (Dolničar, 2021). Despite

their role in food security and income generation, limited production technologies and inferior seed tubers hinder potato cultivation (Lama et al., 2016).

Nepal produces 3,410,829 mt of potatoes annually across 198,256 hectares with an average productivity of 17. 20 t/ha (MoALD, 2023). Potato makes up 2.17% of the country's GDP and 6.34% of the AGDP, ranking 5th in area coverage, second in total production and first in productivity among the food crops grown in Nepal (MoALD, 2023). Although the Baglung district produces 1.49% of the country's potatoes and accounts for 1.57% of its area, its yield (16.25 mt/ha) is lower than the normal for the country (17.20 mt/ha) (MoALD, 2023). Due to high amount of water in potato tubers special care should be given for handling and storage (Gautam, 2016). Post-harvest loss are a significant concern, emphasizing the importance of proper storage methods (Adhikari & G.c, 2021). The major objectives of storage are for future consumption, and maintenance of seed reserves (Khanal & Bhattarai, 2020). Post-harvest losses stem from short shelf life, sprouting, rot, shrinkage and pest infestations (P. Upadhyay et al., 2021). Additionally, post-harvest techniques like curing and grading significantly affect potato quality. The storage life of potato is influenced by both agro-climatic conditions and the storage methods employed (Gautam, 2016). Temperature, humidity, ventilation, light and gas composition are crucial environmental factors affecting potato storage (Czerko et al., 2023). Maintaining optimal pre-harvest conditions and employing scientific post-harvest storage methods are crucial for preserving the quality of potatoes over extended storage periods (Khorramifar et al., 2023). Given the economic significance of potatoes in the Baglung district and the prevalent issue of substantial post-harvest losses, it is crucial to investigate the current status of various potato storage techniques employed in this area.

This study aims to provide valuable insights that can guide the adoption of more efficient storage practices. The district holds great potential for enhancing potato production by adopting modern agricultural technologies and practices. Numerous limitations to the high productivity of potatoes and the unavailability of proper storage services add up to the low total yield and supply. There is also a lack of knowledge among the farmers regarding modern storage techniques such as cold storage for ware potatoes and rustic storage for seed potatoes along with a shortage of other appropriate storage structures. Farmers are not able to gain justifiable prices for their produce as they are compelled to sell it as soon as the mass production takes place in the main season when prices are comparatively lower and cannot fetch good market value.

This study investigates storage techniques used by farmers in the potato zone, and identifies their most preferred storage methods. It also highlights the problems faced by potato growers regarding potato storage. The results will help stakeholders like planners, administrators, policymakers, farmers, and authorities understand different storage techniques and make informed decisions to improve them.

MATERIALS AND METHODS OF RESEARCH

The study was conducted within the PMAMP Potato Zone, Baglung district of Nepal, which is situated in a hilly terrain at an altitude of 1,020 masl from March 10 to July 10, 2024. The survey encompasses the PMAMP potato zones lying in Baglung district, i.e. Dhorpatan municipality, Tarakhola rural municipality and Nisikhola rural municipality selected purposively. In consultation with the PMAMP Potato Zone PIU Baglung office, 94 farmers were selected by simple random sampling technique as sample size using Raosoft calculator at 5% margin of error. Secondary data was gathered from statistical sources like literature, reports, bulletins, articles, and publications from the Ministry of Agriculture and Livestock Development (MoALD), the Nepal Agricultural Research Council (NARC), the Agriculture Knowledge Centre (AKC), and the Prime Minister Agriculture Modernization Project (PMAMP).

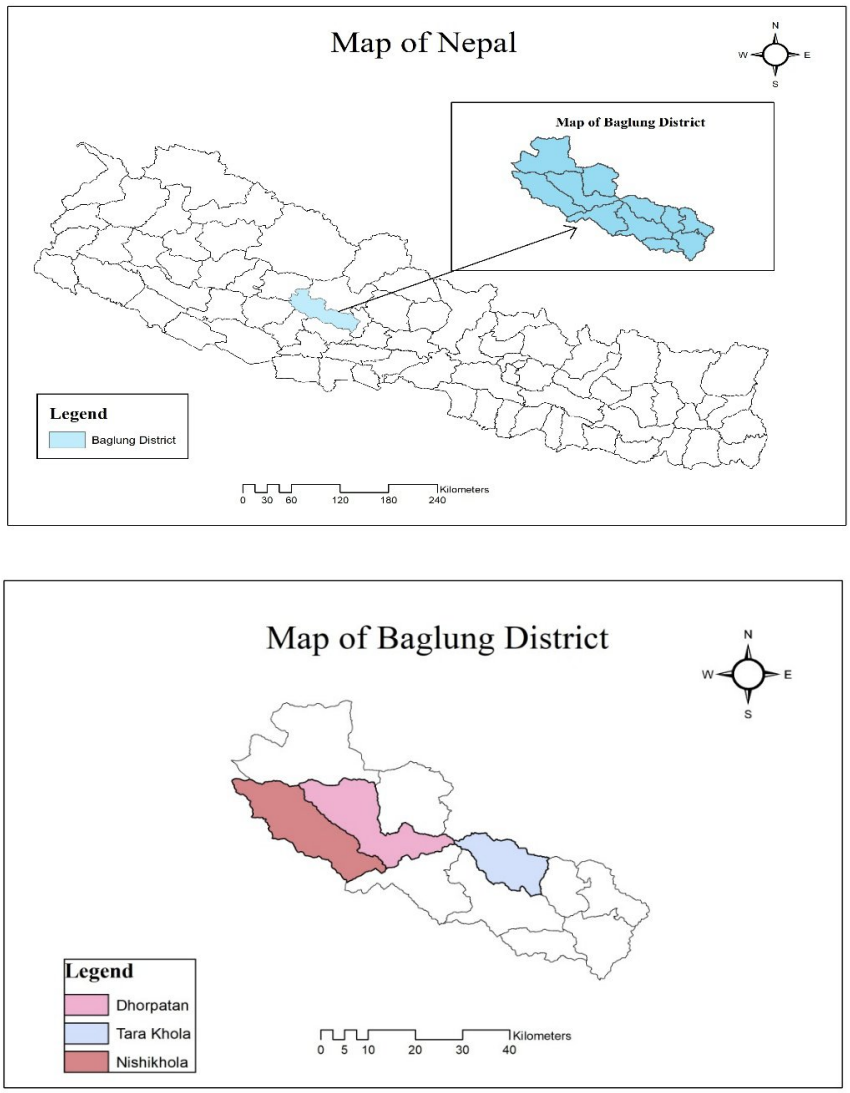

Figure 1 – Map of study area (Source: ArcGIS)

Data collected from both primary and secondary sources was encoded and recorded using Microsoft Excel, while analysis was done with SPSS software. The data was analyzed through statistical methods, including both descriptive and inferential statistics.

RESULTS AND DISCUSSION

The education levels of respondents were based on four categories: Illiterate, Adult education, Basic level education and secondary level and above. Figure 2 revealed that the majority of the respondents had achieved adult education, followed by basic level education, illiterate and secondary level and above education.

From the study it was found that most of the respondents were involved in at least one or more social groups in their community.

Curing is a post-harvest treatment for potatoes for longer storage and quality maintenance done by almost all the respondents. Among 94 respondents, “in shade” curing was the most popular method, used by 64.9% of respondents, due to its quality benefits.

Figure 5 illustrates the primary diseases and insects that adversely impact potato quality during storage. Respondents indicated the incidence of Potato Tuber Moth, bacterial wilt, and bacterial rot. Many of the respondents have also seen more than 2 pest infestations.

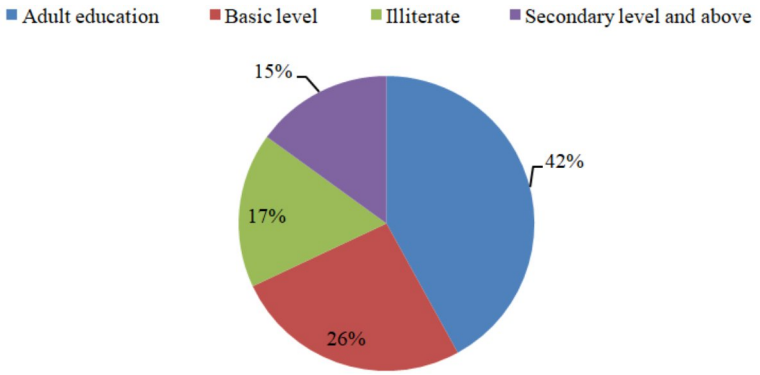

Figure 2 – Education level of respondents in study area

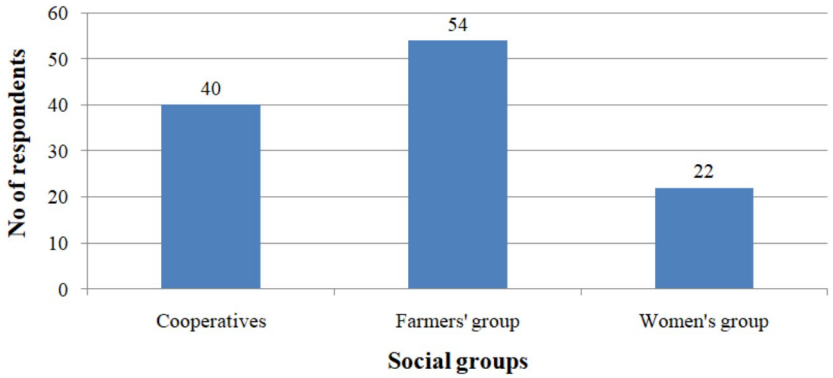

Figure 3 – Involvement of respondents in various social groups

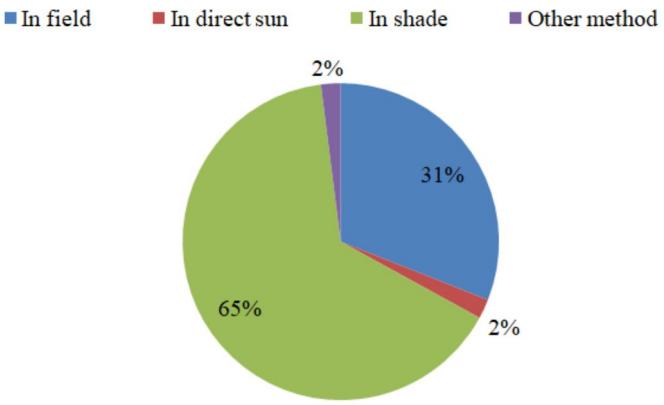

Figure 4 – Different methods of curing used by respondents in the study area

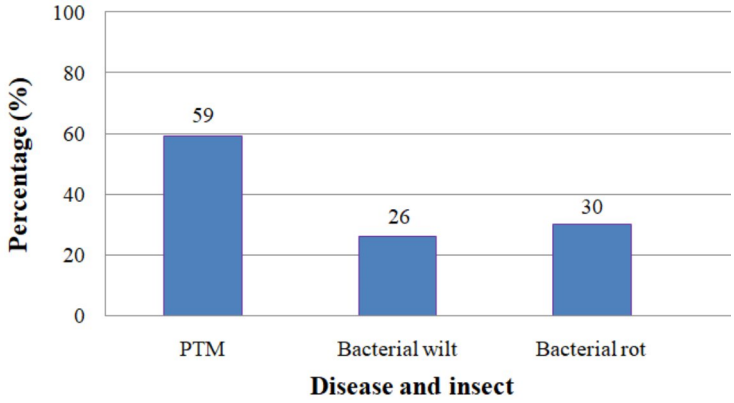

Figure 5 – Disease and Insect infestation of potato in storage conditions in storage condition

It can be observed that wooden boxes were the most popular for storing ware and seed potatoes, followed by bamboo baskets, locally known as *doko* and *dalo.* Similarly, Bamboo container (*Bhakari),* Sacks and room storage were also used.

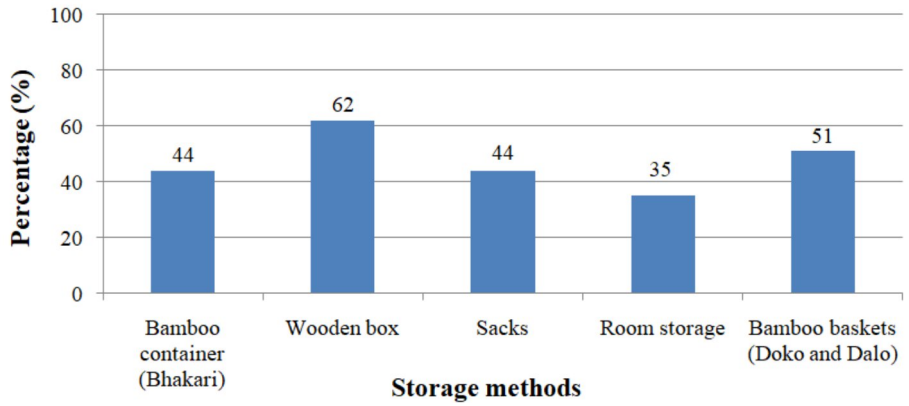

Figure 6 – Storage methods used by respondents in the study area

Among the respondents who used more than one storage methods/techniques for potato that is 78 out of 94, 39% of the respondents reported wooden box as the most effective storage methods for potato, followed by Bamboo bin storage (*Doko* and *Dalo*), Bamboo containers (*Bhakari*), sacks and other storage methods.

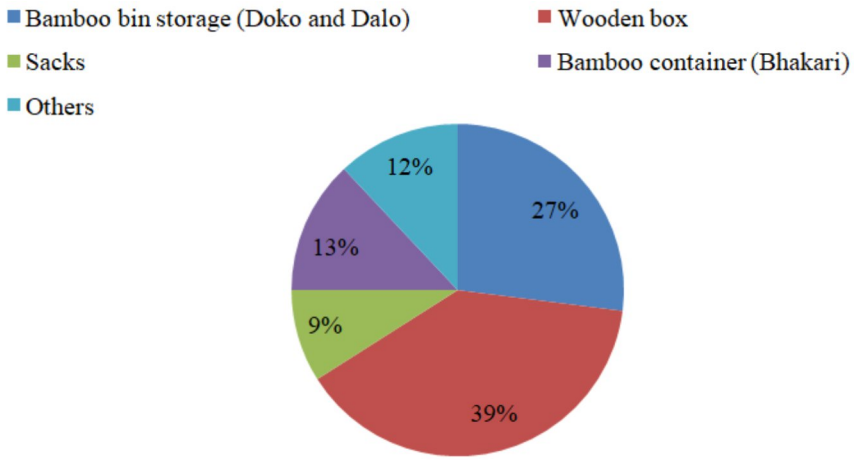

Figure 7 – Most preferred storage methods of respondents in study area

Table 1 – Knowledge of farmers on other storage methods than they currently use

Knowledge on other storage methods	Frequency	Percent
Yes	73	77.7
No	21	22.3
Total	94	100

Table 2 – Knowledge of farmers on modern storage methods

Knowledge of modern storage methods	Frequency	Percent
Yes	41	56.2
No	32	43.8
Total	73	100

Respondents reported the incidence of greening in storage conditions, occurrences of blackheart, pest infestations, and shrinkage problems. Notably sprouting emerged as the most predominant issue, with 83% of respondents indicating its occurrence during storage.

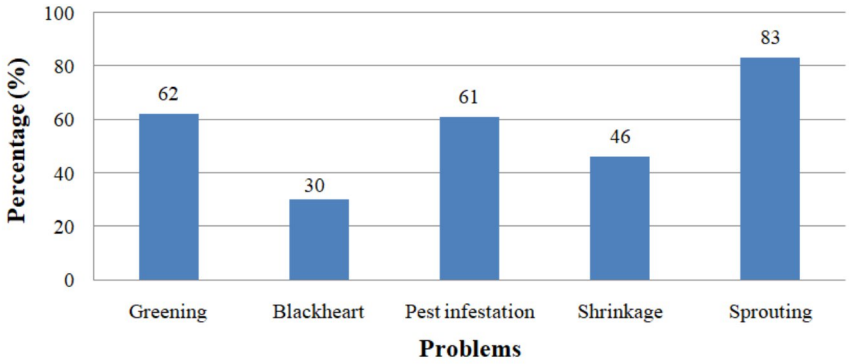

Figure 8 – Problems encountered during storage of potato in study area

Table 3 – Chi - square test value for association between the literacy rate of respondents and the perceived importance of storage conditions of potato

Literacy rate	Perceived importance of potato storage conditions			
	Less important	Important	Most important	Total
Illiterate	0(0.0)	4(4.3)	12(12.8)	16(17.0)
Adult education	0(0.0)	5(5.3)	34(36.2)	39(41.5)
Basic level	1(1.1)	11(11.7)	12(12.8)	24(25.6)
Secondary	1(1.1)	3(3.2)	11(11.7)	15(16.0)
Total	2(2.1)	23(24.5)	69(73.4)	94(100.0)

Figures in the parenthesis indicate expected frequency.
Chi-Square (χ^2 *Cal) = 12.660*** (χ^2 *tab*) $= 12.910$ *P value= 0.049 df=6 Significant at 0.05 level of probability.*

The result signifies that the association between literacy rate of farmers and their perceived importance of storage conditions of potato are statistically significant. It means there is an association between literacy rate of farmers and their perceived importance of storage conditions of potato.

Table 4 – Chi - square test value for association between the involvement of respondents in social groups and their knowledge about other storage methods

Social Groups	Knowledge about other storage methods		
	Yes	No	Total
Yes	61 (64.9)	15 (16.0)	76 (80.9)
No	12 (12.8)	6 (6.4)	18 (19.1)
Total	73 (77.7)	21 (22.3)	94 (100.0)

Figures in the parenthesis indicate expected frequency.
Chi-Square (χ^2 *Cal) = 1.551* (χ^2 *tab*) $= 0.866$ *P value= 0.213 df=1 non-significant at 0.05 level of probability.*

This result signifies that the association between involvement of farmers in social groups and knowledge of farmers regarding other storage techniques are statistically non-significant. It means there is no association between involvement of farmers in social groups and knowledge of farmers regarding other storage techniques.

Table 5 – Chi - square test value for association between the literacy rate of respondents and their knowledge of modern storage methods of potato

Literacy rate	Knowledge of modern storage methods		
	Yes	No	Total
Illiterate	4(5.5)	9(12.3)	13(17.8)
Adult education	14(19.2)	14(19.2)	28(38.4)
Basic level	14(19.2)	6(8.2)	20(27.4)
Secondary	9(12.3)	3(4.1)	12(16.4)
Total	41(56.2)	32(43.8)	73(100.0)

Figures in the parenthesis indicate expected frequency.
Chi-Square (χ^2 *Cal) = 7.122* (χ^2 *tab*) $= 7.292$ *P value= 0.068 df=3 non-significant at 0.05 level of probability.*

This result signifies that the association between literacy rate of farmers and their knowledge of farmers about modern storage techniques by them are statistically non-

significant. It means there is no association between literacy rate of farmers and their knowledge of modern storage techniques.

Reducing the post-harvest loss of food crops is more important than increasing the yield. By reducing post-harvest loss, food availability can be significantly increased, thereby enhancing food security without the immediate need to increased production (Gc & Ghimire, 2019). Potatoes from Baglung district, particularly from Tarakhola and Dhorpatan are known for their excellent taste and quality. However, despite this, local farmers struggle to achieve sufficient returns compared to their production costs. Among various other reasons, post-harvest loss is a major one. Post-harvest loss is accelerated by the poor cultivation and intercultural practices, and most importantly the use of conventional storage practices. The farmers do not replace the seeds as needed and use local varieties only due to which the infestation of disease and insects has been increasing with time. The pest cycle evolves and adapts itself to changing environment due to the recurring host.

The findings align with those of P. Upadhyay et al. (2021), who found out that the primary factors contributing to potato losses after harvest included the use of potato varieties that have a short shelf life, the early onset of sprouting, rot and shrinkage of tubers and infestation by potato tuber moths. As stated by Khanal & Bhattarai (2020), the major types of storage practices that were mostly identified were traditional ones like bamboo baskets, jute sacks and wooden boxes. Wooden boxes are popular in high altitude regions like Dhorpatan and Nishikhola as they prevent the potatoes from frost during colder seasons. Similarly in comparatively warmer places like Tarakhola, bamboo baskets and containers were used as they provide enough ventilation. The knowledge of respondents regarding the modern methods of storage like cold store is significant but they have not yet been able to use it.

The association between literacy rate of farmers and level of importance of storage of potato by them are statistically significant. It means there is an association between literacy rate of farmers and level of importance of storage of potato.

CONCLUSION

The study's findings revealed that the various storage methods used for potato storage were among the traditional ones. Most farmers used more than one storage methods. Use of wooden box was the most popular storage method among farmers followed by the use of traditional bamboo baskets (*Doko* and *Dalo*) and bamboo container (*Bhakari*). Wooden box was again the most preferred method of storage. Respondents seemed to have little knowledge about the modern methods of storage like the cold storage and rustic storage and have not yet used or gained more insights about them.

Almost all of the respondents were familiar with and performed curing practice after harvest and preferred shade curing method for few weeks. Potato tuber moth was the predominant storage pest followed by bacterial wilt. Similarly, respondents reported blight as the predominant disease in field conditions that hampered the quality of stored potatoes after harvest. Sprouting was the major physiological problem associated with storage which was seen after as early as after 30 days of harvest. Potato greening also occurred in storage conditions where there was incidence of direct light. In colder regions stored potatoes often rotted because of frost and cold air currents passing through the small gaps and crevices of storage apparatus and containers. The association between literacy rate of farmers and their perceived importance of storage conditions of potato was statistically significant. It means there is an association between literacy rate of farmers and their perceived importance of storage conditions of potato.

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REFERENCES

1. Adhikari, B., & G.c, A. (2021). Post-harvest practices of horticultural crops in Nepal: Issues and management. Archives of Agriculture and Environmental Science, 6(2), Article 2. https://doi.org/10.26832/24566632.2021.0602015.
2. Bajracharya, M., & Sapkota, M. (2017). Profitability and productivity of potato (Solanum tuberosum) in Baglung district, Nepal. Agriculture & Food Security, 6(1), 47. https://doi.org/10.1186/s40066-017-0125-5.
3. Czerko, Z., Zarzyńska, K., & Boguszewska-Mańkowska, D. (2023). Chapter 14—Postharvest physiology and storage of potato. In M. E. Çalişkan, A. Bakhsh, & K. Jabran (Eds.), Potato Production Worldwide (pp. 261–272). Academic Press. https://doi.org/10.1016/B978-0-12-822925-5.00001-3.
4. Dolničar, P. (2021). Importance of Potato as a Crop and Practical Approaches to Potato Breeding. Methods in Molecular Biology (Clifton, N.J.), 2354, 3–20. https://doi.org/10.1007/978-1-0716-1609-3_1.
5. Gairhe, S., Gauchan, D., & Timsina, K. P. (2017). Adoption of improved potato varieties in Nepal. https://hdl.handle.net/10568/82894.
6. Gautam, I. (2016). Seed and Ware Potato Storage and processing status in Nepal.
7. Gc, A., & Ghimire, K. (2019). Estimating post-harvest loss at the farm level to enhance food security: A case of Nepal. International Journal of Agriculture Environment and Food Sciences, 3(3), Article 3. https://doi.org/10.31015/jaefs.2019.3.3.
8. Khanal, S., & Bhattarai, K. (2020). Study on Post Harvest Losses in Potato in Different Storage Conditions. Journal of Food Science and Technology Nepal, 12, 14–19. https://doi.org/10.3126/jfstn.v12i12.25298.
9. Khorramifar, A., Rasekh, M., Karami, H., Lozano, J., Gancarz, M., Łazuka, E., & Łagód, G. (2023). Determining the shelf life and quality changes of potatoes (Solanum tuberosum) during storage using electronic nose and machine learning. PLOS ONE, 18(4), e0284612. https://doi.org/10.1371/journal.pone.0284612.
10. Lama, T. L., Khatri, B. B., & Dhakal, S. P. (2016). Status And Prospects Of Potato Research And Development In Nepal.
11. Oli, A., & Devi, R. A. (2022). Varietal evaluation of different potato (Solanum tuberosum L.) varieties. The Pharma Innovation Journal.
12. P. Upadhyay, K., Paudel, N., Aryal, S., Simkhada, R., Bhusal, B., Thapa, B., Subedi, G., & P. Gautam, I. (2021). Post-Harvest Losses Of Potato Genotypes At Farmers' Storage Conditions. Sustainability in Food and Agriculture, 2(1), 51–56. https://doi.org/10.26480/sfna.01.2021.51.56.
13. Tiwari, J. K., Buckseth, T., Challam, C., Zinta, R., Bhatia, N., Dalamu, D., Naik, S., Poonia, A. K., Singh, R. K., Luthra, S. K., Kumar, V., & Kumar, M. (2022). CRISPR/Cas Genome Editing in Potato: Current Status and Future Perspectives. Frontiers in Genetics, 13. https://doi.org/10.3389/fgene.2022.827808.