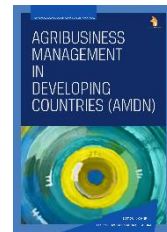


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RESEARCH ARTICLE

ASSESSMENT OF THE POST-HARVEST LOSSES OF POTATO IN BANEPA MUNICIPALITY OF KAVREPALANCHOK DISTRICT

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ABSTRACT

The study was conducted to assess the status of post-harvest loss of potato from the farmer's field to the ultimate consumer in the Banepa-municipality of Kavrepalanchok district. A total of 100 respondents were randomly selected out of which 35 were farmers and processors each and 30 were traders. The required information was obtained with the help of pre-tested semi-structured questionnaires, and additionally, secondary data were obtained from the PMAMP annual report, AKC annual report, ADD, and MoALD. In the present study, post-harvest loss can be experienced at different levels of farmers, traders, and processors and different conditions such as farms, while harvesting to transporting, and also at different storage conditions in Banepa municipality. According to the respondents' different factors were responsible for post-harvest losses in farmers. The post-harvest loss of potato mainly occurred due to rotting (10.74%) followed by weight loss (8.89%), insect damage (4.44%), mechanical injury (2.55%), and leftover (2.42%). The total post-harvest loss in the farmers' field is 29.04%. Similarly, in the trader's level post-harvest loss of potato mainly occurred due to the small size of potatoes 17.45% followed by weight loss 9.15%, rotting 8.92%, insect damage 7.66% and finally Greening 7.11%. The total post-harvest loss in traders is 50.29%. In the case of processor post-harvest loss of potato mainly occurred due to excess wastage 20.46% followed by rotting 12.3%, weight loss 8.74%, processing wastage 8.60% and finally insect damage 7.34%. The total post-harvest loss in processors is 57.44%. Thus, the insights gained from this study aimed at reducing post-harvest losses and improving the overall efficiency of the potato supply chain in Banepa municipality.

1. INTRODUCTION

1.1 Background Information

Potato (*Solanum tuberosum*) is an annual herbaceous plant native to the South American Andes and a widely used tuber crop in the food industry. They were grown by the Incas in the 13th century and they were brought to Europe by the Spanish in the 16th century where they were used as an ornamental plant. Potatoes were first served to normal people in the 18th century as an alternative food source in the times of war when there was a shortage of other food materials. Belonging to the Solanaceae family, it is one of the most important vegetable crops consisting of about 75 to 80% water, 16 to 20% carbohydrates, 2.5 to 3.2% crude protein, 1.2 to 2.2% true protein, 0.8 to 1.2% mineral matter, 0.1 to 0.2% crude fats, 0.6% crude fiber and different vitamins (Reddy et al., 2018). In terms of global consumption, it is the third most important food crop and has been highly recommended by the Food and Agriculture Organization of the United Nations as a food security crop (Devaux et al., 2014).

Potato is considered one of the most important food commodities, with a total global production of 370 million tonnes in 2019 (FAOSTAT, 2021). China is ranked first in the world with the production of 91 million tonnes of potatoes in 2019, which is equivalent to nearly 25% of the total world's production (FAOSTAT, 2021). Nepal contributed only 0.84% of the global production of potatoes (FAOSTAT, 2021). Nepal is largely an agricultural country. Agriculture contributes 27% to the national gross domestic product (GDP) with 66% of the total population being engaged in Agriculture (MoALD, 2076). Potato is cultivated in 193,997 ha in Nepal with production of 3,112,947 Mt and productivity of 16.05 Mt/ha (AITC, 2020). The average yield of potato is very low in our country as compared

to the world average and that of neighboring countries China and India. That's why we can say that there is a much higher potential for potato production in Nepal. This can be reached by adopting suitable agronomic practices and creating farmer-friendly environments.

Kavrepalanchok is one of 77 districts of Nepal, near Kathmandu valley having an area of 1396 sq. ft, situated in a mid-hilly area majorly having a subtropical climate and elevation range of 280 meters to 3018 meters (Bethanchok Narayan Danda). Kavrepalanchok is one of the highest potatoes producing districts due to its topography and climatic conditions suitable for commercial potato cultivation. Potatoes are short-duration crops that are generally harvested 3 to 4 months after planting. When we remove a crop from the field, it starts to deteriorate. Numerous biochemical processes continuously change the original composition of the crop until it becomes unmarketable thus resulting in post-harvest losses. Therefore cleaning, sorting, and packing help to manage the post-harvest losses. The objective of the study was to study the socio-economic aspect of potato growers, traders, and processors of the Kavrepalanchok district. To analyze the post-harvest losses in farmer's fields, traders, processing, and supply at Banepa-municipality of Kavrepalanchok district. To study the factors affecting the post-harvest losses of potatoes at different levels (farmers, traders, and processors).

1.2 Potato Cultivation In Nepal

Potato is one of the fourth most important staple crops after rice, maize, and wheat in Nepal. It is cultivated in 198,788 ha with a production of 3,325,231 mt and a productivity of 16.73 mt/ha (MoALD 2010/21). Potato production under cash crop in the current FY 2021/22 is estimated to increase by 3.9 percent as compared to FY 2020/21 and will reach

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34,54,000 metric tons (MoF 2021/22). Potato became economically important only in the 19th century and now grown in different parts of Nepal (Rhoades, 1985). It is grown in higher elevations in mountains and is the major source of seeds for farmers in lower hills and lowlands because of their disease-free status (Rhoades 1985). The production system of potatoes varies according to altitude. In the lowland Terai, potatoes are typically cropped after upland paddy or jute during the winter. In the mid-hills (800-1,500 masl), potatoes are mainly planted on irrigated land after paddy. From 1,500 to 1,800 meters, the mixed cropping is done with maize while at 2,500 and above, mainly monocropping of potatoes is practiced (Rhoades 1985). The National Potato Research Program (NPRP) of the Nepal Agricultural Research Council (NARC) is involved in developing and testing improved potato varieties in Nepal, while the Potato Development Programme (PDP) of the Department of Agriculture is involved in dissemination and production of improved potato varieties and technologies throughout District Agricultural Development offices (DADOs) located across 75 districts of the country (Gairhe 2017).

1.3 Concept Of Post-Harvest Loss

All those activities that are performed immediately after the harvest until they reach the consumer are known as Post-Harvest handling. This includes harvesting, precooling, transport, cooling, cleaning, sorting, grading, packaging, marketing, etc. Post-harvest loss refers to any change in the commodity after harvest that hinders its normal consumption (Giri, 2020). Potato being semi-perishable has an intermediate life span as compared to perishable and nonperishable commodities. Post-harvest losses of potato were estimated at 24% in India, 20 percent in Bangladesh, and 25 % in Nepal (Upadhyay, 2020). The causes of post-harvest losses are disease infestation, weight loss, shrinkage, and sprouting during storage which impede the earnings of the farmers (Giri, 2020). Therefore, a year-round supply of potatoes is made possible by storing them in different storage conditions. The post-harvest losses like sprouting are suppressed and damage is minimized either by cooling, refrigeration, or by using a sprout suppressant. Post-harvest technology of potatoes helps to ensure the quality of potatoes, checking their loss and fulfilling the year-round

demand of the processing and consumption market (Giri, 2020).

1.4 Post-Harvest Loss In Different Conditions

Post-harvest loss can be experienced in different conditions such as farms, while harvesting transporting, and also at different storage conditions. The mean harvest loss at the different commodities like rice, wheat, maize, potato, mustard, cabbage, lentil, etc at the farm level is 5% (G.C and Ghimire 2019). Similarly, average harvest and transportation-related losses of 12.45 and 11.7 % were estimated in the Dedo and Seka districts respectively of Southwest Ethiopia (Kuyu, 2019). We can also see the post-harvest loss in different storage conditions. Cold storage of potatoes resulted in minimum storage loss while in-house storage suffered maximum storage loss (Khanal, 2016). The causes of post-harvest storage loss of potatoes are moisture change, respiration sprouting and deterioration, etc. Post-harvest loss also depends upon the variety we cultivate. From the above data, we can say that post-harvest loss is a major problem existing in agricultural commodities.

1.5 Management Of Post-Harvest Losses

At the farm level mechanical injury can be minimized by replacing the machines with human labor and also with careful handling. Similarly places with poor storage conditions have to sell their harvest at a shorter period than stored for periods, since they are highly prone to after harvest losses. (Kuyu, 2019) For longer transportation special care should be given during loading and unloading. Among the traditional storage systems, in-basket storage was found to be the best storage system. For seed potato storage, where sugar accumulation is not a problem, cold storage can be the most suitable (Khanal, 2016).

1.6 Trend Analysis

1.6.1 World Scenario Of Potato Production

The average global production of potatoes is on a decreasing trend till year 2019 and in 2020 and 2022, it is on an increasing trend (Figure 1).

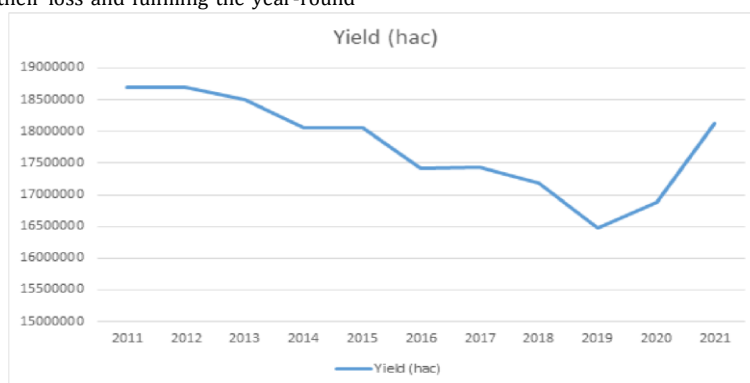


Figure 1: Trend Analysis of Potato Production in World (2011-2021)

Source: (FAOSTAT, 2022)

China is one of the leading countries in potato production followed by India and the Russian Federation respectively. The average yield of these

countries is 87.18 million tons, 47.26 million tons, and 25.82 million tons respectively (Figure 2).

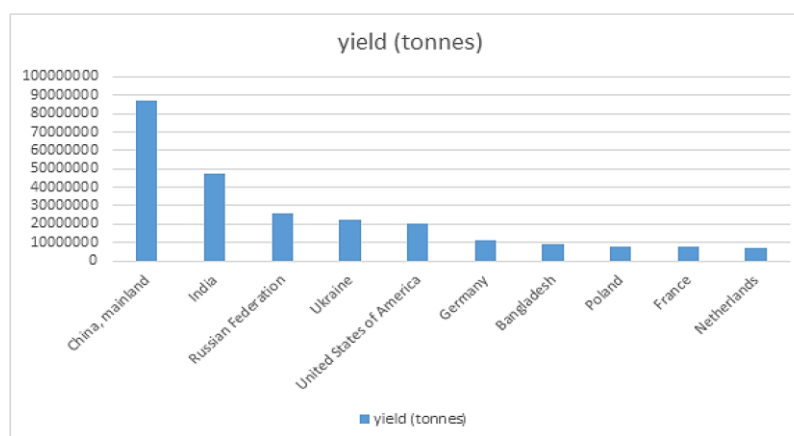


Figure 2: Trend Analysis of Potato Production of the world's top 10 countries

Source: (FAOSTAT, 2022)

1.6.2 Trend Analysis Of Potato Production In Nepal

The potato production in Nepal has been increasing in the last decade. The production increased from 2.5 million metric tons in 2011/12 to 3,3 million metric tons in 2020/21 (Table 1). Though the production has increased by 0.8 metric tons in 10 years the increased production is not satisfactory.

Table 1: Production trend of potato in Nepal from 2011-12 to 2021-22

Year	Area(ha)	Production (mt)	Yield(tons/ha)
2011/12	190,250	2,584,301	13.58
2012/13	197,234	2,690,421	13.64
2013/14	205,725	2,817,512	13.70
2014/15	197,037	2,586,287	13.13
2015/16	199,971	2,805,582	14.03
2016/17	185,879	2,591,686	13.94
2017/18	195,268	3,088,000	15.81
2018/19	193,997	3,112,947	16.05
2019/20	188,098	3,131,830	16.65
2020/21	198,788	3,325,231	16.73
2021/22	198,256	3,410,829	17.20

Source: (MoALD, 2022)

Kavre district has a suitable climate for potato production. Here farmers cultivate potatoes 2-3 seasons per year and they have decent earnings with potato production. Here we can see the average production of potatoes from 2014/15. The production of potato was increasing till 2018/19 along with area and yield. Then in the years 2019/20 and 2021/21 the area, production, and yield started decreasing (Table 2). The reason behind the decreasing trend is people are changing their occupation from agriculture to other sectors.

Table 2: Trend Analysis of Potato Production in Kavre district (2014/15-2020/21)

Year (A.D)	Area(ha)	Production (metric ton)	Yield(mt/ha)
2014/15	9755	181419	18.597
2015/16	9785	184622	18.868
2016/17	-	-	-
2017/18	9785	198653	20.302
2018/19	9912	204111	20.59
2019/20	8169	145103	17.76
2020/21	9159	175670	19.18
2021/22	8909	194766	21.86

Source: (MoALD, 2022)

2. METHOD AND METHODOLOGY

2.1 Site Selection

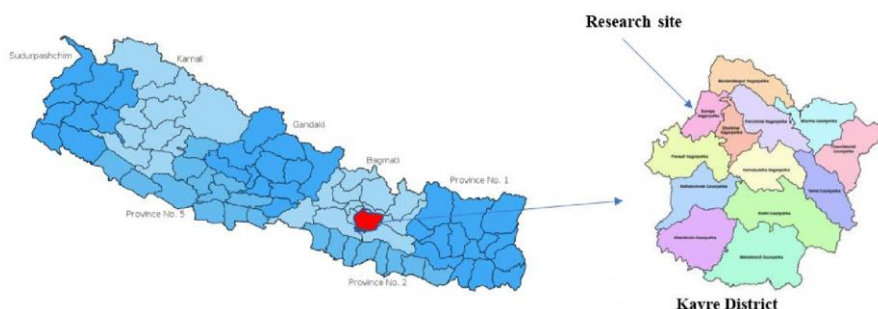


Figure 3: Map of Nepal showing the study area

The study was carried out at the Banepa municipality of Kavre district, Federal Democratic Republic of Nepal from Chaitra 25 to Ashar 29 of 2079/80. The site is located at 27° 38' 4.45" N latitude and 85° 31' 24.07" E longitude (Figure 3). The site was purposefully selected as a reasonable area for the study as the majority of the population here are engaged in the cultivation, distribution, and marketing of potato. These areas are under the command of PMAMP, Program implementation unit (Super zone - Potato), Kavre.

2.2 Preliminary Study

A preliminary study was conducted to gather information on the feasibility of the research. Direct observations and interactions with farmers and PMAMP staff were used to assess the study site qualities.

This data was utilized to prepare the interview schedule and create the sampling frame.

2.3 Sampling Procedure and Techniques

Samples from 7 wards of Banepa-municipality were taken to present the whole population. The sampling frame was prepared by collecting the list of potato growers, traders, and processors through the PMAMP, potato super zone office, and also from other local sources. A total of 100 samples out of which 35 potato growers (5 growers from each municipality), 30 traders, and 35 processors were selected based on simple random sampling and convenience sampling.

2.4 Research Design

Field surveys, field observations, and secondary information collection were used to collect the data.

2.4.1 Pre-testing

The interview schedule was pretested before being administered to actual respondents to ensure reliability and validity. Pre-testing was conducted on 10% of respondents who live near the study area. The necessary changes were made as per the requirements in the schedule.

2.4.2 Household survey/interview schedule

The information regarding the potato grower's socio-economic information, land information, cultivation practices of potatoes, harvesting, problems faced by farmers after harvesting, postharvest losses in a farmer's field, storage, transportation, and marketing related to potatoes was collected from farmers by interview (Appendix 1; survey questionnaire). The respondents were interviewed by visiting either their farms or their houses. Regular checking and validation of information was done immediately after filling out a questionnaire.

2.4.3 Field Observations

Field observations were done to get a quick summary of potato production to processing in a farmer's field, trader place, and processing unit conditions. Throughout the research, several trips to these places were made with careful assessments of current conditions.

2.5 Data and Data Types

Both primary and secondary data were collected and used in this research.

2.5.1 Primary Data

The primary data was collected from potato growers, traders, and processors of selected regions through semi-structured questionnaires, and telephone surveys.

2.5.2 Secondary Data

The secondary source of data was collected from journal articles, government publications, and reports, newspapers, and web profiles of relevant NGOs, and INGOs. The source of secondary data includes annual reports of PMAMP potato super zones, publications of FAO, NARC, AKC, CBS, and MOALD, and different journals and articles.

2.6 Data Analysis

The information collected from the site was first coded and entered into the computer. The collected data entry was done by Microsoft Excel 2021 whereas quantitative and quantitative data were analyzed by using the tool SPSS 2022 (Statistical package for social science). Similarly, problems faced by respondents on post-harvest losses were collected and ranked with the use of the index.

2.6.1 Data analysis Technique

The data obtained from the farmers, traders, wholesalers, and retailers was edited and their unit of measurement was changed to standard one. All the data obtained from the questionnaire was coded, entered, and analyzed by using Statistical Package for Social Survey (SPSS) and MS. Excel software.

Post-harvest loss was calculated by adding the factors that are responsible for PHL. For example, during harvesting, 18 kg of potatoes were cut and

the total production was 60 maunds¹ or 2400 kg. Thus, the cutting loss was estimated as $(18 \times 100/2400)$ 0.75%. Similarly, other harvesting losses were estimated in terms of total production.

Total post-harvest loss (PHL) = weight loss + sprouting loss + pathological loss + other factors.

3. RESULTS

3.1 Socio-Economic Status

3.1.1 Age

Out of the total 35 farmers surveyed at the production level, 31-40 and 41-50 aged group people were mainly involved in potato cultivation at 31.42% (11) followed by 51-70 aged group people at 20% (7) and then 21-30 aged people 17.14% (6) (Figure 5). Out of the total 30 traders surveyed, 31-40 aged people were mainly involved in trading 40% (12) followed by 41-50 aged people 36.67% (11), 51-70 aged people 13.37% (4) and finally 21-30 aged people 10% (3). Out of the total 35 processors surveyed, 21-30 aged and 51-70 aged people were mainly involved in processing 25.71% (9) followed by 31-40 aged people 28.57% (10) and then 41-50 aged people 20% (7). The study showed the population who were actively involved in Potato cultivation and trading were 31-40 aged people while 21-30 aged and 51-70 aged people were mainly involved in processing (Figure 4).

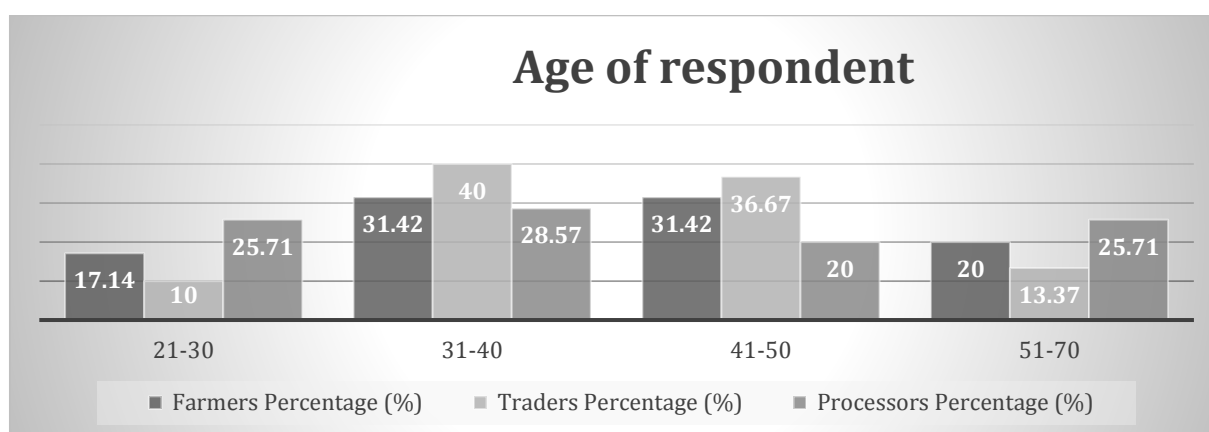


Figure 4: Distribution of respondents based on age in Banepa municipality of Kavrepalanchok district

3.1.2 Education Level

The education level of most of the respondents 45.7% (16) in the study area was secondary followed by 25.7% (9) primary, 20% (7) Graduates and only 8.6% (3) respondents were illiterate (Figure 7). The education level of the study area was categorized into four categories viz. illiterate (can't read and write), primary (1-8), secondary (8-12) and Graduate. Education level of most of the respondent 46.7% (14) in the study area was primary followed by 30% (9) secondary, 20% (6) illiterate and only 3.3% (1) respondent were Graduate. The study showed that mainly primary and secondary education level people were involved in all levels i.e. production, trading, and processing.

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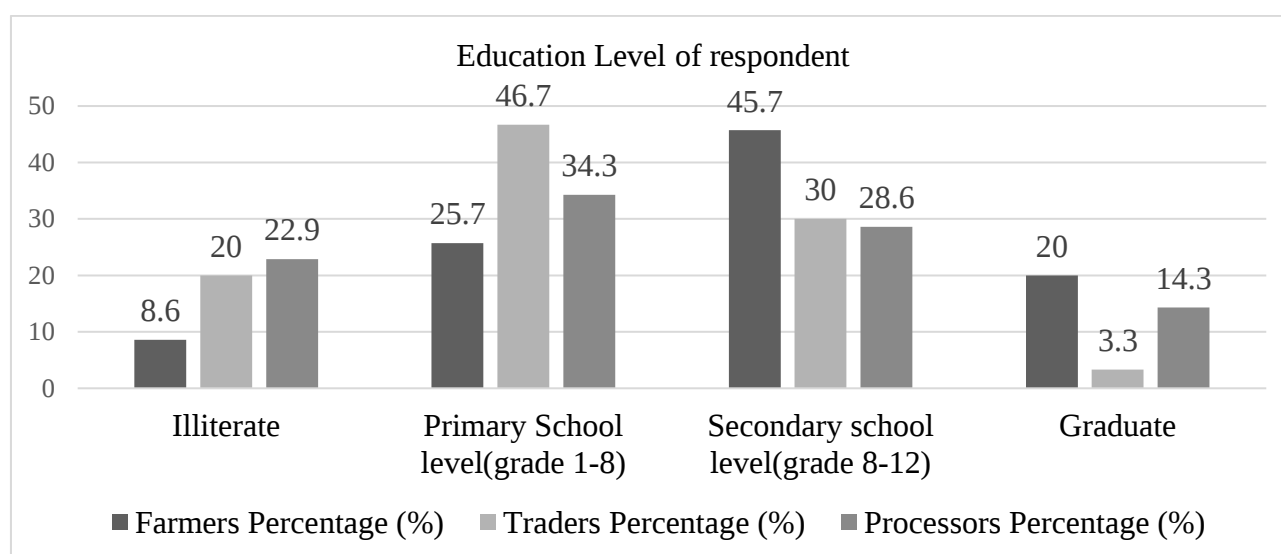


Figure 5: Distribution of respondents based on education level in Banepa municipality of Kavrepalanchok district

3.1.3 Land Holdings for potato cultivation (in ropani)

The table shows that the minimum land holding is 1 ropani, maximum land holding is 23 ropani and average land holding is 6.77 ropani (Table 3).

Table 3: Land Holdings for potato cultivation (in ropani) of farmers of Banepa municipality of Kavrepalanchok district		
Minimum		1 ropani
Maximum		23 ropani
Mean		6.77 ropani

3.1.4 Land Holding Type

Most of the farmers of the sampled area used to have their land for potato cultivation i.e. 57.1% (20). Some people used to take land on lease for potato cultivation i.e. 17.1% whereas others used to cultivate on both i.e. 25.7% (9) (Table 4).

Table 4: Land Holdings type of farmers of Banepa municipality of Kavrepalanchok district		
Land Holding type	Frequency	Percentage (%)
Both	9	25.7
Leased land	6	17.1
Own land	20	27.1
Total	35	100

3.2 Potato Cultivation information:

3.2.1 Number of seasons of potato cultivation:

Generally, farmers of the sample area grow potatoes either in 1 season or in 2 seasons in a year.

Table 5: Varieties of potato used by farmers of Banepa municipality of Kavrepalanchok district			
Variety used	Number of responses	Response Percentage %	Percentage of Case
Janakdev	27	41.54	77.14
Jhapri	12	18.46	34.29
Desiree	8	12.31	22.85
British	3	4.62	8.57
Goloseito	4	6.15	11.43
Cardinal	5	7.69	14.29
Golorato	6	9.23	17.14
Total	65	100	185.71

3.2.4 Cultivation Of Potato For

Out of the total 35 farmers surveyed at the production level, cultivation for only seed is 2.9% (1), for only home consumption is 5.7% (2), and for both home production and seed production is 8.6% (3). However, the maximum farmers cultivate for all purposes i.e. home consumption, seed production, and the main selling 82.9% (29).

3.2.5 Type Of Seed Used

All the seeds used in the sample area were Farmer's seed.

3.2.6 Sources Of Potatoes

Out of the total 35 farmers surveyed at the production level, they collect potatoes from different sources. Among them, the major sources of potatoes were both owned and neighbors 62.9% (22) followed by only owned farms 31.4% (11). After that, the market and subsidy have an equal share of 2.9%.

3.2.7 Change Of Seed

Most of the people change their seed 1-3 years i.e. 48.6% (17) followed by 4-6 years i.e. 25.7% (9). Some people change when it starts performing badly i.e. 17.1% (6) whereas some never buy new seeds (Table 6).

More no. of farmers grows in 2 seasons i.e. 60% (21) while rest grow in 1 season i.e. 40% (14)

3.2.2 Potato growing season:

In the sampled areas, Farmers grow potatoes mostly in Winter and Rainy 60% (21) followed by Winter 31.4% (11), and then Spring 8.6% (3) (Figure 6).

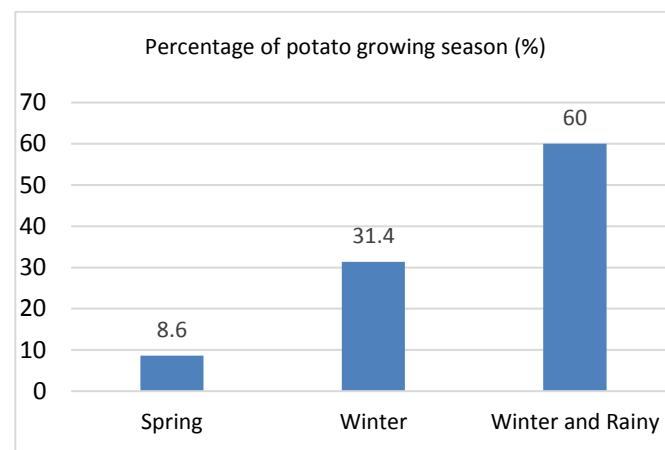


Figure 6: Potato growing season of farmers of Banepa municipality of Kavrepalanchok district

3.2.3 Varieties of potato used

Out of the total 35 farmers surveyed at the production level, Janakdev was the most popular among farmers followed by Jhapri, Desiree, Golorato, Cardinal, Goloseito, and finally British (Table 5).

Table 6: Change of seed by the farmers of Banepa municipality of Kavrepalanchok district		
Change of seed	Frequency	Percentage (%)
1-3 year	17	48.6
4-6 year	9	25.7
Never buy new seed	6	17.1
When it starts performing badly	3	8.6
Total	35	100

3.2.8 Sources of Technical Guidance

Out of the total 35 farmers surveyed at the production level, farmers getting no technical assistance and farmers getting technical assistance from PMAMP are 42.9% (15) each. After that farmers getting technical assistance from agro-vet is 14.3% (5) (Table 7).

Table 7: Sources Of technical Guidance of the farmers of Banepa municipality of Kavrepalanchok district		
Sources of technical guidance	Frequency	Percentage%
Agro-vet	5	14.3
Noone	15	42.9
PMAMP	15	42.9

3.2.9 Problems Encountered During Potato Cultivation

In sampled areas, all the problems were encountered in every farm. The problems were Insects and pests, Diseases, and Irrigation.

3.2.10 Severity

The problems encountered in the form of sampled areas were categorized into the following categories. Mostly, the farm is in less severe condition i.e 45.7% (16) followed by moderate condition i.e 37.1% (13) (Table 12). After that the condition is least severe i.e. 14.3% (5) and then severe

condition 2.9% (1).

3.3 Pre-Harvest Related Information

3.3.1 Prepare For Harvesting

In the sampled area, most of the farmers prepare for harvesting by cutting shoots 1-2 days before harvest 48.6% (17) followed by cutting shoots just prior to harvest 34.3% (12). Very few people practice dehaulming 11.4% (4) and leave the shoot to dry 5.7% (2) (Figure 7).

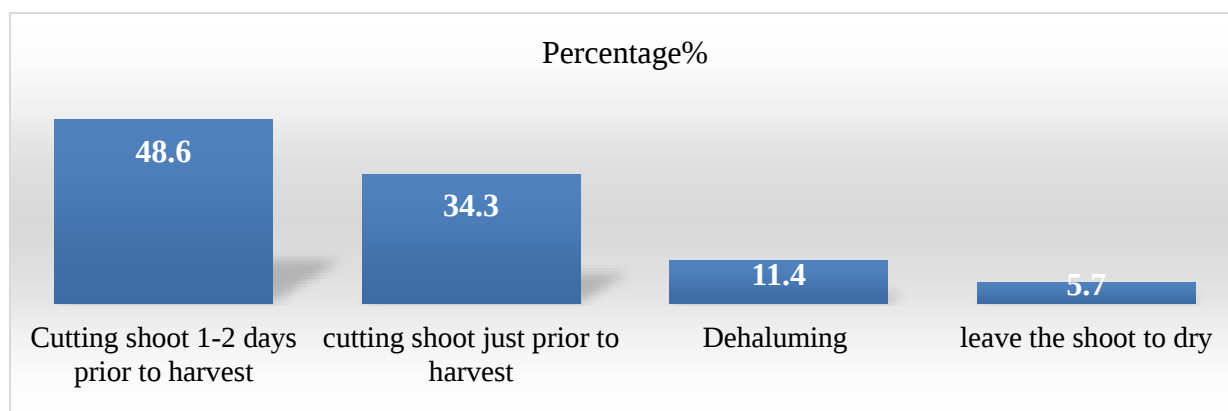


Figure 7: Prepare for harvesting Potato Cultivation in Banepa municipality of Kavrepalanchok district

3.4 Harvest Related Information

3.4.1 Method of Harvesting

All farmers used manual method for harvesting potatoes

3.4.2 Type Of Labor Used

In the sample area, both family and casual labor are used 51.4% (18) followed by Family labor 28.6 % (10) and then Permanent labor 20% (7).

3.4.3 Time Of The Day Of Harvest

In the sample areas, farmers generally harvest morning and afternoon 57.1% (20). Some harvest morning and evening 20% (7) while some harvest afternoon 17.1% (6). Very few farmers harvest in either evening or in the morning 2.9% (1).

Table 8: Time of the day of harvest by the farmers of Banepa municipality of Kavrepalanchok district		
Time of the day of harvest	Frequency	Percentage%
Afternoon	6	17.1
Morning and afternoon	20	57.1
Evening	1	2.9
Morning	1	2.9
Morning and evening	7	20
Total	35	100

3.4.4 Production Of Potato In Sack

In the sample areas, the sampled farmers mostly grow potatoes in less than 50 sacks 37.14% (13). After that farmers grow potatoes in 100-200 sacks 28.57% (10) followed by 50-100 sacks 25.71% (9). Very few farmers grow potatoes in more than 200 sacks 8.57% (3). This shows that more commercialization is still much needed in the hands of a few farmers rather than a large number of farmers.

3.4.5 Protect The Harvested Potatoes From The Sun

All the farmers protect the harvested potatoes from direct sun by putting them in bags.

3.5 Post-Harvest Related Information: Farmers

3.5.1 Pre-Storage Practice Use

Most of the farmers practice both grading and sorting 77.1% (27) while few farmers practice only grading 22.9 % (8).

3.5.2 How To Grade Potatoes

Among the farmers that practice grading, they grade their potatoes, by size charts i.e. small, medium, and large 77.1% (27).

3.5.3 Stage Of Grading

Among the farmers who practice grading, they grade their potatoes at different stages. Generally, they grade during harvest 57.1% (20) followed by when selling 14.3% (5), and then just before storing 5.7% (2).

3.5.4 Store Potato After Harvest

Out of the farmers surveyed, 31.4% (11) store their potatoes in a dark area of the house followed by 25.7% (9) stored in a cold store, 22.9% (8) kept covered in a mud floor house and 20% (7) kept uncovered in a concrete floor house.

3.5.5 Manage Insect In Post-Harvest Storage

Out of the farmers surveyed, 51.4 % (18) chose to practice the chemical pesticide to manage insects in post-harvest storage while 48.6% (17) chose to have titepati extract. This shows that chemical pesticide is slightly preferable then organic method of managing insect in post-harvest storage.

3.5.6 Means Of Transportation

From the farm to the processing unit, Processors mostly use mini trucks 48.57% (17) while others carry on back 40% (14) and use hand carts 11.43% (4).

3.5.7 Marketing Channel Use

After the potatoes are grown, they are marketed in different ways. The most used marketing channel is Mediator-Retailer-Consumer 68.6% followed by Directly to consumer 17.1% (6). Some farmers don't need a marketing channel because they don't sell their potatoes 11.4% (4). While only 2.9% (1) use the marketing channel of retailer-consumer.

3.5.8 Packaging Material

Among the farmers surveyed, most of them use jute bags 88.6% (31), while the proportion of using mesh bags and plastic bags is equal i.e. 5.7% (2).

3.5.9 Preference Of Packaging Materials

Among the farmers surveyed, they prefer the packaging material because of the following reasons: Most of them use bags because they are locally available 88.6% (31) while the proportion of using bags because of cost-effective and other reasons equal i.e. 5.7% (2).

3.5.10 Factors Contributing Post-Harvest Loss

All these factors are responsible for post-harvest losses and they are Weight loss, leftovers, mechanical injury, insect damage, and rotting

3.5.11 Post Harvest Management Cost

Out of 35 sampled populations, the expense of post-harvest management costs are as follows. Mostly the farmers have around Rs.5000-10000 42.9% (15) followed by <Rs.5000 37.1% (13). Few farmers have the expense of > Rs.20000 14.3% (5) and then Rs 10000-20000 5.7% (2). The cost of post-harvest management mainly depends upon the production area (Table 23).

3.5.12 Training To Prevent Post-Harvest Loss

To prevent post-harvest loss, farmers take training from different sources. Most of the farmers do not take any training as they depend on the knowledge given by their forefathers or learned by here and there 42.9% (15). Those who take training take from PMAMP 37.1% (13). followed by Agrovet 20% (7).

3.5.13 Perception As Potato Farmer

Most of the farmers are satisfied as potato farmers 77.1% (27) while few farmers are not satisfied 22.9% (8).

3.6 Traders

3.6.1 Kind Of Potato Business

Traders are involved in the following kinds of business. Most of them are doing as retailers 80% (24) followed by wholesalers 13.3 % (4). Very few are doing it as both retailers and wholesalers 6.7% (2).

3.6.2 Source of Potatoes

All potatoes that are traded are sourced from inside the country.

3.6.3 Selling Destination

Out of 30 traders surveyed, most of them sell their potatoes generally in local markets 76.7% (23) based on the demand while others only sell their potatoes in both local and distant markets 23.3% (7).

3.6.4 Time Of Business

Out of 30 traders surveyed, they have been doing their business for 1-2 years 33.3% (10) and 2-5 years 33.3% (10) followed by >5 years 23.3 % (7) and then <1 year 10% (3).

3.6.5 Contact The Farmers

Out of 30 traders surveyed, they contact the farmers mainly through direct contact with farmers 53.3% (16) followed by using brokers 30% (9). However, some traders sell their own potatoes 13.3% (4), and only a few are found by visiting the farms 3.3% (1).

3.6.6 How To Grade Potatoes

Among the traders that practice grading, they grade their potatoes by size charts i.e. small, medium, and large 70% (21) while others remove the damaged ones 30% (9).

3.6.7 Transportation From The Farm To Traders

From farms to consumers, Traders mostly use mini trucks 80% (24) while others use hand carts 20% (6).

3.6.8 Packaging Material

Among the traders surveyed, all of them use jute bags.

3.6.9 Preference Of Packaging Materials

Among the traders surveyed, they prefer the packaging material as they are cost-effective.

3.6.10 Post-Harvest Losses

All the traders experience post-harvest damages.

3.6.11 Factors Contributing Post-Harvest Loss

Weight loss, rotting, insect damage, greening, and small potatoes all these

factors contribute to post-harvest loss.

3.7 Processors

3.7.1 Sources Of Potatoes

For the processing of potatoes, they bring potatoes from different sources. Mainly they source it from traders 37.1% (13) while self and direct from farmers is of the same proportion i.e 31.4% (11).

3.7.2 Qualities In Choosing Varieties

While choosing the varieties, certain characteristics are taken into consideration for processing. Mostly all qualities like color, shape, size, and texture are taken into consideration 28.6% (10). Color, size, and texture are considered equally i.e. 14.3% (5) each. While some don't consider any specific quality 22.9% (8).

3.7.3 Transportation From The Farm To Processing Point

From the farm to the processing unit, Processors mostly use mini trucks 68.6% (24) while others use hand carts 31.4% (11).

3.7.4 Losses From Processing Potatoes

All types of losses were seen while processing potatoes in the sample areas. The losses were Weight loss, rotting, insect damage, greening, sprouting, and excess wastage.

3.8 Post-Harvest Loss

3.8.1 Post-Harvest Losses Of Potatoes In Farmers

The table below reveals that in farmers' fields post-harvest loss of potato mainly occurred due to rotting 10.74% followed by weight loss 8.89%, insect damage 4.44%, mechanical injury 2.55% and finally leftover 2.42%. The total post-harvest loss in the farmer's field is 29.04%.

3.8.2 Post-Harvest Losses Of Potatoes In Traders

The table below reveals that in trader's post-harvest loss of potato mainly occurred due to small potatoes 17.45% followed by weight loss 9.15%, rotting 8.92%, insect damage 2.55% and finally Greening 7.11%. The total post-harvest loss in traders is 50.29%.

3.8.3 Post-Harvest Losses Of Potatoes In Processors

The table below reveals that in the processor's post-harvest loss of potato mainly occurred due to excess wastage 20.46% followed by rotting 12.3%, weight loss 8.74%, processing wastage 8.60 % and finally insect damage 7.34%. Total post-harvest loss in processors is 57.44.

3.8.4 Total post-harvest losses of potatoes at all levels

The study shows that the total post-harvest loss is maximum at processors 57.44% followed by traders 50.29% and then farmers 29.04%.

4. DISCUSSION

Several studies carried out in Assessment of Post-Harvest losses of Potato. Post-Harvest losses can occur at various stages of the supply chain, including harvesting, sorting, cleaning, handling and packing, transportation, storage, distribution, marketing and processing (Degebase, 2020). Harvesting contributes to the most significant portion of total on-farm potato losses (Raghuvanshi and Gauraha, n.d.). Manual potato harvest with spades results in higher incidence of tuber cuts and bruises (Sah and Bagale, 2024). Inadequate storage infrastructure and inappropriate post-harvest handling techniques are significant contributors to elevated postharvest losses (Sah and Bagale, 2024). Potato storage losses can be attributed to combination of factors, including insect infestation, lack of cold storage facilities, and inappropriate post-harvest handling practices and these practices encompass extend curing periods, excessive filling of potato sacks, dragging heavy bags and inadequate sorting and grading procedures (Sah and Bagale, 2024). Post-harvest losses are to be attributable to inadequate harvesting practices and the direct loading of produce for transport without the utilization of appropriate packaging material (Kumarasamy and Dhanasekarapandian, 2019). Inefficiencies primarily stem from losses attributable to rotting and moisture fluctuations. Weight loss exhibits a positive correlation with storage duration (Paudel et al., 2023). Potato tuber rot during storage is primarily attributed to fungal pathogen, including dry rot and soft rot (Paudel et al., 2023).

Aim of this study was to assess the post-harvest losses of potato in Banepa Municipality of Kavrepalanchok district. This study investigated post-harvest potato losses across the agricultural supply chain in Banepa municipality, Nepal. The research identified losses at various stages, from farm harvest and transportation to storage conditions. Farmers primarily experienced losses due to rotting (10.74%), followed by weight loss (8.89%), insect damage (4.44%), mechanical injury (2.55%) and leftovers (2.42%). Weight loss, rotting, insect damage, greening and undersized potatoes accounting for the height loss (17.45%). Processors faced losses due to factors like excess wastage (20.46%), rotting (12.3%), weight loss (8.74%), processing waste (8.60%) and insect damage (7.34%). Overall, post-harvest potato losses were highest among processors (57.44%), followed by traders (50.29%) and farmers (29.04%). These findings highlight the need for improved post-harvest handling practices at all stages of the supply chain to minimize potato losses.

5. CONCLUSION

This study concludes that post-harvest loss can be experienced at different levels of farmers, traders, and processors and different conditions such as farms while harvesting to transporting, and also at different storage conditions in Banepa municipality. Different factors are responsible for post-harvest losses in farmers and they are Weight loss, leftovers, mechanical injury, insect damage, and rotting. In farmers' fields post-harvest loss of potato mainly occurred due to rotting 10.74% followed by weight loss 8.89%, insect damage 4.44%, mechanical injury 2.55% and finally leftover 2.42%. The total post -harvest loss in the farmers field is 29.04%. Weight loss, rotting, insect damage, greening, and small potatoes all these factors contribute to post-harvest loss to loss in traders. The trader's post-harvest loss of potato mainly occurred due to small potatoes 17.45% followed by weight loss 9.15%, rotting 8.92%, insect damage 7.66% and finally Greening 7.11%. The total post -harvest loss in traders is 50.29%. Weight loss, rotting, insect damage, greening, sprouting, and excess wastage are these factors that contribute to postharvest loss in processors. The processor's post-harvest loss of potato mainly occurred due to excess wastage 20.46% followed by rotting 12.3%, weight loss 8.74%, processing wastage 8.60 % and finally insect damage 7.34%. The total post -harvest loss in processors is 57.44%.

Thus, we can say that total post -harvest loss is maximum at processors. This could be due to losses during processing activities, storage, or transportation from farms to processing units. After that, the total post-harvest loss is at traders. This could be due to issues in transportation, storage, or handling practices during the distribution process. However, in the farmer's field, there is very little total post-harvest loss and these post-harvest losses are attributed to factors such as inadequate storage facilities, transportation issues, or lack of proper harvesting techniques.

In conclusion, the research provides a holistic view of the potato value chain in the study area, highlighting the complexities and challenges faced at each stage. The insights gained from this study can inform policymakers, agricultural extension services, and stakeholders to develop targeted interventions and strategies aimed at reducing post-harvest losses and improving the overall efficiency of the potato supply chain in Banepa municipality.

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