



Farmers' Knowledge and Management Practices Regarding Disease and Insect Pest of Potato at Chautara Sangachokgadhi Municipality, Sindhupalchok District, Nepal

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Abstract

A study was conducted in three wards of Chautara Sangachokgadhi Municipality, Sindhupalchok district, aimed to assess farmers' knowledge of potato diseases and their management practices. A total of 105 randomly selected farmers participated in the study. Late Blight emerged as the predominant potato disease, while potato scab was identified as the least common. Although a substantial number of farmers were aware of Late Blight, knowledge of potato scab was limited. Chemical control methods were widely employed, with cultural and biological methods also utilized, but integrated disease management (IDM) practices were notably underutilized. The study identified five prevalent insect pests in potatoes, with the tuber moth being the most severe and Jassid the least severe. Despite the predominance of chemical control, the integration of physical, cultural, biological, and chemical methods was infrequently adopted. Furthermore, the majority of farmers demonstrated limited awareness of integrated pest management (IPM). Demographically, the majority of farmers identified as Hindu and engaged in agriculture as their primary occupation. Brahmin/Chhetri and Janajati communities were prevalent. The study revealed that the knowledge categorization was higher at a medium level, indicating the need for targeted training and awareness programs to enhance farmers' understanding of potato disease and pest management practices. In conclusion, the findings underscore the importance of tailored educational initiatives to address knowledge gaps and promote sustainable practices in potato farming in the studied region.

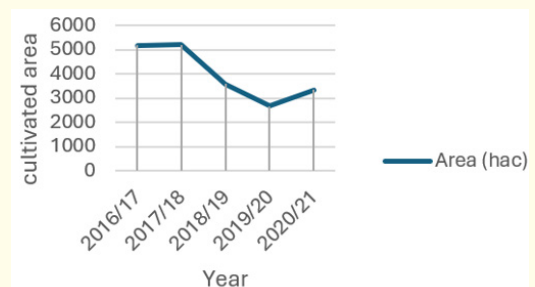
Keywords: Blight; Disease; Insect; Knowledge; Management

Introduction

Potato (*Solanum tuberosum* L.) belongs to Solanaceae family. Plant is an erect herbaceous, aromatic, and sparsely hairy with tuber-bearing underground edible stolon [1]. Roots are shallow extent up to two feet [2]. In Nepal, potato was believed to be first introduced in 1793 [3]. It is considered as the first among non-grains crop and the king of vegetables [4]. In Nepal, it is also ranking in the fourth most important crop after rice, maize, and wheat. In addition, it is the second most important cash crop of Nepal after oilseed [5]. Potato is the most staple food in Hill and Mountain regions of Nepal, however, potato is used as subsidiary vegetables in Terai region [6].

Major diseases of potato are bacteria, fungi, viruses, nematodes and phytoplasmas. These pathogens cause serious disease in the potato plant and reduce the production. Late blight, caused by *Phytophthora infestans*, is the most common fungal disease of potato [7] and Bacterial wilt, caused by *Ralstonia solanacearum* (known as *Pseudomonas solanacearum*), is the dominant bacterial disease of potato in

the world [8]. Potato plant can be infected by an approximately 160 diseases. Among them, 50 are caused by fungi, 10 by bacteria, 40 by viruses and others by nonparasitic [9]. In Uganda, most common potato disease is late blight which is followed by bacterial wilt [10]. Similarly, in Ethiopia, Late blight, for example, is the most common disease in potato [11]. In Nepal as well, late blight and bacterial wilt are the most dominant potato disease [12].



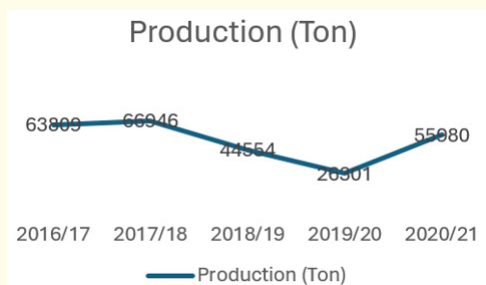


Figure 1: Trend of potato cultivation and production in Sindhupalchok
Source: [13]

Research Methodology

Survey site and data collection.

The study was conducted in Chautara Municipality, Sindhupalchok district, Nepal. Survey were conducted in three wards of Chautara Sangachokgadhi Municipality, out of its 12 wards 3 wards namely, Kubinde, Batase and Simpane. Site of survey was selected purposefully. Sub-tropical to sub-temperate type of climate is found in the district. These areas were selected on the basis of their higher production potential of potato in the district and also these areas were considered as Potato zone. The total population of Chautara Municipality was 46,501. Total of 105 households within the sampling framework were selected randomly. So, total sample number were 105 for this study. KII and FGD were carried out to cross check the collected data.

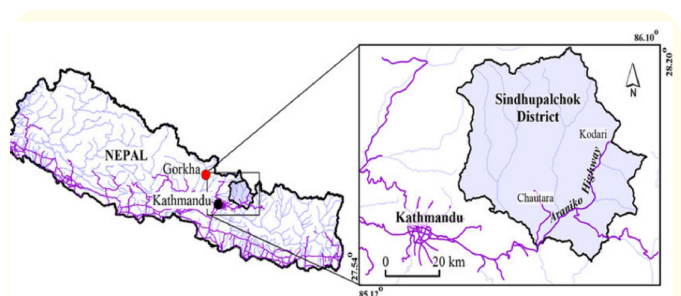


Figure 2: Map showing Chautara Sangachokgadhi Municipality of Sindhupalchok district.

Data analysis Data were analysed using SPSS and Microsoft Excel. The Likert scale was used to measure the Knowledge of respondents. Scoring was used to find the level of knowledge and indexing was done.

Likert scale

Farmers' knowledge towards problems was presented in the five-point scaling technique comprising most severe, severe, moderate, mild and most-mild. The scale values of 1, 0.8, 0.6, 0.4 and 0.2 were used for most severe, severe, moderate, mild and most-mild problems, respectively. Mathematically,

$$I = \sum \frac{S_i F_i}{N}$$

Where, I = Index value ($0 < I < 1$)

S_{ii} = Scale value

FF_{ii} = Frequency of importance given by the respondents

N = Total numbers of respondents

Knowledge index

The knowledge index (K.I.) of each respondent was computed by using the following formula:

$$K.I. = \frac{\text{Score obtained}}{\text{Maximum possible score}} * 100$$

The respondents were grouped into three categories based on their knowledge where farmers were questioned regarding their level of knowledge indices over the use of chemical pesticides where 21 different questions were asked and based in their answer we categorized them into three categories viz. low, medium and high.

Ethnicity	Overall (N = 105)	Batase (n ₁ = 35)	Simpane (n ₂ = 35)	Kubinde (n ₃ = 35)	Chi-square
Brahmin/Chhetri	51 (48.6)	16 (45.7)	32 (91.4)	3 (8.6)	48.699***
Janajati	48 (45.7)	17 (48.6)	2 (5.7)	29 (82.9)	
Dalit	6 (5.7)	2 (5.7)	1 (2.9)	3 (8.6)	

Table 1: Ethnicity of respondents.

Note: Figures in parenthesis indicate percentage. *** indicate significant at 1% level of significance.

Ethnicity of respondents

Majority farmers are Brahmin/Chhetri i.e. 48.6%. It was followed by Janajati 45.7% and Dalit 5.7% which is nearly doubled than national average of 27.74% Brahmin/Chhetri [14].

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Table 2: Ethnicity of respondents.

Note: Figures in parenthesis indicate percentage. *** indicate significant at 1% level of significance.

Religion of respondents

Majority of farmers were found to be Hindu 69 (65.7%)/105 (100%). It was followed by Buddhist 30 (28.6%)/105 (100%) and Christian 6 (5.7%)/105 (100%). The difference in composition of religion between three wards was found to be significant at 1% level of significance.

Education of respondents

The study found a significant difference in educational status among three wards of Chautara Municipality, with 35.2% being illiterate, 32.4% having primary, 28.6% having secondary, and 3.8% having higher education. However, the study shows that the literacy rate of sample population is 64.8% which is slightly lower than national average of 76.2% [14].

Religion	Overall (N = 105)	Batase (n ₁ = 35)	Simpane (n ₂ = 35)	Kubinde (n ₃ = 35)	Chi-square
Hindu	69 (65.7)	16 (45.7)	34 (97.1)	19 (54.3)	24.887***
Buddhist	30 (28.6)	17 (48.6)	0 (0)	13 (37.1)	
Christian	6 (5.7)	2 (5.7)	1 (2.9)	3 (8.6)	

Table 3: Religion of household

Note: Figures in parenthesis indicate percentage. *** indicate significant at 1% level of significance.

Education level	Overall (N = 105)	Batase (n ₁ = 35)	Simpane (n ₂ = 35)	Kubinde (n ₃ = 35)	Chi-square
Illiterate	37 (35.2)	11 (31.4)	11 (31.4)	15 (42.9)	17.906***
Primary level	34 (32.4)	15 (42.9)	6 (17.1)	13 (37.1)	
Secondary level	30 (28.6)	6 (17.1)	18 (51.4)	6 (17.1)	
Higher education	4 (3.8)	3 (8.6)	0 (0)	1 (2.9)	

Table 4: Education status of household head.

Note: Figures in parenthesis indicate percentage. *** indicate significant at 1% level of significance.

Farmers' ability

Farmers from Simpane and Kubinde 85.7% and 77.1% were able to identify LB respectively. This study was also supported by [15] which states that almost all respondents from Paucartambo and Ulcumayo identified LB. Hence, 2/3rd of farmers (selected for interview) said they can identify LB. According to [16] diseases along with EB was identified using artificial intelligence with 99.4% accuracy while in our study area only 79% farmers were able to identify EB. Farmers who were not able to identify potato virus was found higher 80% at Batase followed by Simpane 31.4% and Kubinde 8.6% respectively. This study was also supported by [17] which states that over 50 virus species have been recognized globally whereas in Bangladesh, only 7

potato viruses have been identified by farmers. In addition, 32.4% farmers in our study were aware of pink rot disease which is higher in comparison to [18] who reported that only 10% farmers identified pink rot in Nebraska. Scab was identified by only 12.4% of farmers from three wards of Chautara municipality which is very low in comparison to research conducted by [19].

Major disease of potato

As per table 5, in three wards of Chautara municipality, LB was found the most dominant potato disease and EB was found to be the second most common disease which is followed by Potato Virus. Potato scab was found to be the least common disease.

Disease	Identification	Overall	Batase (n ₁ = 35)	Simpane (n ₂ = 35)	Kubinde (n ₃ = 35)	Chi-square
Late Blight	No	16 (15.2)	3 (8.6)	5 (14.3)	8 (22.9)	2.802
	Yes	89 (84.8)	32 (91.4)	30(85.7)	27 (77.1)	
Early Blight	No	22 (21)	11 (31.4)	11 (31.4)	0 (0)	13.916***
	Yes	83 (79)	24 (68.6)	24 (68.6)	35 (100)	
Potato Virus	No	42 (40)	28 (80)	11 (31.4)	3 (8.6)	38.810***
	Yes	63 (60)	7 (20)	24 (68.6)	32 (91.4)	
Pink Rot	No	71 (67.6)	26 (74.3)	19 (54.3)	26 (74.3)	4.263
	Yes	34 (32.4)	9 (25.7)	16 (45.7)	9 (25.7)	
Potato Scab	No	92 (87.6)	28 (80)	32 (91.4)	32 (91.4)	2.809
	Yes	13 (12.4)	7 (20)	3 (8.6)	3 (8.6)	

Table 5: Farmers ability to identify disease of potato.

Note: Figures in parenthesis indicate percentage. *** indicate significant at 1% level of significance.

S.N.	Major diseases	Weight	Index	Rank
1	Late Blight	105	1	I
2	Early Blight	84	0.8	II
3	Potato Virus	62.8	0.598	III
4	Pink Rot	39	0.371	IV
5	Potato Scab	24.2	0.230	V

Table 6: Major diseases of potato.

Variety more susceptible to disease

It was found that Khumal Ujjwal variety of potato was found to be the most susceptible variety of potato towards disease. Second most susceptible variety of potato was found Khumal Rato 2 which was followed by Cardinal. The results showed that MS-42 was found more resistive variety of potato in compare to other four varieties.

Management practice followed for disease

As per table 7, majority of farmers 37 (35.2%) out of 105 in overall are using chemical method for disease management of potato. Physical or cultural method of disease management is the second most common control method in Chautara Municipality which is followed by biological control method 29 (27.6%). Least common method of disease control in Chautara Municipality was mixing of physical, biological plus chemical. Only 5 (4.8%) out of 105 farmers said they are applying the combination of physical, biological and chemical methods of disease controlling potato. According to table 7, chemical method of disease management were found higher 15 (42.9%) at Kubinde in compare to Batase and

S.N.	Variety susceptible	Weight	Index	Rank
1	Khumal Ujjwal	99.6	0.948571	I
2	Khumal Rato 2	87.4	0.832381	II
3	Cardinal	62.4	0.594286	III
4	Janak Dev	43	0.409524	IV
5	MS-42	21.8	0.207619	V

Table 7: Susceptible varieties towards disease based on farmers' knowledge.

Simpane. Farmers who followed physical/cultural management method were found higher 15 (42.9%) at Batase. Similarly, farmers who followed biological management method were found higher 18 (51.4%)/105 (100%) at Simpane. Moreover, 4 (11.4%)/35 (100%) farmers in Batase have an idea of control method by mixing physical, biological and chemical. Only 1 out 35 farmers in Kubinde said know about the combination of physical, biological and chemical method of disease management in potato. However, none of the farmers in Simpane know about the combination of physical, biological and chemical method of disease management.

This study is also supported by [20] which states that majority of farmers 99% followed chemical method for disease management and control which was higher than in Chautara Municipality.

Integrated disease management

In overall, only 7 (6.7%) out of 105 (100%) respondents said know about IDM method of disease management in potato. 14.3% farmers have been practicing IDM in Batase and only 5.7% farmers

Practices	Overall (N = 105)	Batase (n ₁ = 35)	Simpane (n ₂ = 35)	Kubinde(n ₃ = 35)	Chi-square
Chemical	37 (35.2)	11 (31.4)	11 (31.4)	15 (42.9)	20.308***
Physical/cultural	34 (32.4)	15 (42.9)	6 (17.1)	13 (37.1)	
Biological	29 (27.6)	5 (14.3)	18 (51.4)	6 (17.1)	
Physical + Biological + Chemical	5 (4.8)	4 (11.4)	0 (0)	1 (2.9)	

Table 8: Management practices for disease.

Note: Figures in parenthesis indicate percentage. *** indicate significance at 1%.

know about IDM in Kubinde. However, it was found that none of the farmers have been tried IDM control method before in Simpane. This research was also supported by [21] which states that 98% farmers relied on application of fungicides, mostly mancozeb

but very few farmers showed any elements of IDM strategies, probably due to their limited knowledge of the biology of late blight which was similar to Chautara where 93.3% farmers were found to be unknown to IDM.

IDM	Overall (N = 105)	Batase (n ₁ = 35)	Simpane (n ₂ = 35)	Kubinde (n ₃ = 35)	Chi-square
No	98 (93.3)	30 (85.7)	35 (100)	33 (94.3)	5.816**
Yes	7 (6.7)	5 (14.3)	0 (0)	2 (5.7)	

Table 9: Integrated Disease management Knowledge.

Note: Figures in parenthesis indicate percentage. ** indicate significance at 5% level of significance.

Insect

Major insect in the study area

From the respondent's information, Potato Tuber Moth (PTM) was found an extremely severe insect and Jassid was found to

be the least severe insect. This study was also supported by [22] which states that farmers of South Kivu Province of Congo ranked Cutworms, Aphids and PTM as the most severe insect pests in medium altitude zone.

S.N.	Major insect	Weight	Index	Rank
1	PTM	101.4	0.965714	I
2	Red Ant	87	0.828571	II
3	Aphid	63	0.6	III
4	Wireworm	38.6	0.367619	IV
5	Jassid	25	0.238095	V

Table 10: Major insect.

Management practice used for insect

Like as disease management in potato, majority of farmers 36 (34.3%) out of 105 in overall have been using chemical method for insect management of potato. Physical or cultural method of insect management comes in the second position which is followed by biological control method of insect which is 30 (28.6%)/105.

Least common method of insect control in Chautara Municipality was found to be the combination of physical, cultural, biological and chemical. Only 6 (5.7%) out of 105 farmers said they are applying the combination of physical, cultural, biological and chemical methods of insect control in potato

Practices	Overall (N = 105)	Batase (n ₁ = 35)	Simpane (n ₂ = 35)	Kubinde (n ₃ = 35)	Chi-square
Chemical	36 (34.3)	10 (28.6)	11 (31.4)	15 (42.9)	18.585***
Physical/Cultural	33 (31.4)	15 (42.9)	6 (17.2)	12 (34.3)	
Biological	30 (28.6)	6 (17.1)	18 (51.4)	6 (17.1)	
Physical + biological + chemical	6 (5.7)	4 (11.4)	0 (0)	2 (5.7)	

Table 11: Management practices for insects.

Note: Figures in parenthesis indicate percentage. ***indicate significance at 1%.

Problem ranking

From the farmers' point of view, insect and disease incidence was the primary problem in the study area. The subsequent problems were ranked as inadequate agri-inputs, inadequate quality seed, weeds and lack of irrigation. According to [23] which found that the main problem in the Nalanda district of Bihar was the high incidence of illness and pests, with an average Garret score of 82.33% (I), also provided support for this study.

S.N.	Problems	Weight	Index	Rank
1	Disease and insect pests	105	1	I
2	Inadequate agri-inputs	84	0.8	II
3	Inadequate quality seed	49.2	0.468571	III
4	Weed	47.2	0.449524	IV
5	Lack of irrigation	29.6	0.281905	V

Table 12: Major problem for potato farming.

Knowledge category

From the farmers' point of view (Table 12), out of 105 (100%), majority of farmers 96 (91.4%) were categorized as medium level of knowledge whereas 9 (8.6%) were categorized as farmers knowing high level of knowledge. Among the categorization of medium knowledge level 96 (91.4%), Kubinde was found highest 34 (97.1%) followed by Simpane 32 (91.4%) and Batase 30 (85.7%) respectively. Furthermore, in case, categorization of high knowledge level, Batase was at top 5 (14.3%) followed by Simpane 3 (8.6%) and Kubinde 1 (2.9%) respectively.

Level	Overall (N = 105)	Batase (n ₁ = 35)	Simpane (n ₂ = 35)	Kubinde (n ₃ = 35)	Chi-square
Medium	96 (91.4)	30 (85.7)	32 (91.4)	34 (97.1)	2.917
High	9 (8.6)	5 (14.3)	3 (8.6)	1 (2.9)	

Table 13: Knowledge level.

Note: Figures in parenthesis indicate percentage.

Consequently, the result was found insignificant.

Conclusion

The study was focused on farmers' knowledge or idea about diseases of potato. Also, the research was focused on finding the most common disease management practices in Chautara Municipality, Sindhupalchowk. As per farmers selected from three wards, LB was found the most dominant potato disease and Potato Scab was found to be the least common disease. The study found that 2/3rd farmers selected as sample have an idea about LB. Similarly, majority of farmers 79% were capable of identifying EB, however, major-

ity of farmers 87.6% and 67.6% have no idea about Potato Scab and Pink Rot respectively. 60% respondents have knowledge about Potato Virus. %. The study found that the least common method of disease management was the combination of physical, biological plus chemical which is only 4.8% where most use method is chemical method i.e. 35.2%. in case of insect management chemical method was used by 34.3% of total respondents and least common method found to be the combination of physical, cultural, biological and chemical which is 5.7%.

On the basis of data collected from total farmers, 91.4% were categorized as having medium knowledge, while 8.6% were categorized as having high knowledge. Kubinde 97.1% had the highest medium knowledge level, followed by Simpane 91.4% and Batase 85.7%. However, Batase 14.3% had the highest high knowledge level, followed by Simpane 8.6% and Kubinde 2.9%.

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