

A STUDY ON COFFEE LEAF RUST AND FARMER'S MANAGEMENT PRACTICES IN LALITPUR DISTRICT

Shashank KAFLE*¹ and Rojan KARKI²

Himalayan College of Agriculture Science and Technology, Kathmandu

*Corresponding Author's email: shawshankkafle17@gmail.com

ABSTRACT

This study was conducted to assess coffee leaf rust (CLR) prevalence and farmers' management practices. Eighty farmers from five VDCs in Lalitpur were interviewed. The survey found diseases to be the primary issue for 60% of farmers, with CLR being the most damaging (80%). White stem borer infestations were also significant (91%). Thuladurlung had the highest disease incidence (71%), while Gimdi had the lowest (57.5%). The average disease intensity was 2.65 on a scale of 1-4, with Gimdi scoring the highest at 2.52 and Pyutar the lowest at 2.22. Most farmers (79%) used Bordeaux mixture, and 48% had received training on CLR. The study identified a lack of cultural practices, organic manure, essential nutrients, and biological control agents, and a need for more research on CLR in Nepal.

Keywords: Coffee leaf rust, Disease, Management, White Stem Borer

INTRODUCTION

Coffee is one of the most important cash crops in Nepal as well as the world. Coffee plants belong to the genus *Coffea* L. of the family Rubiaceae. *Coffea arabica* L. (arabica coffee) and *Coffea canephora* Pierre ex Froehner (robusta coffee) are the two species of *Coffea* now commercially cultivated throughout coffee-growing countries. Of the two, Arabica produces the better beans – and consists of about 70 percent of the harvest in the world (Acharya et al., 2014).

Nepal produces around 450 metric tons of green bean coffee annually, almost 70 percent of which is exported. In Nepal there are about 27 thousand farmers growing coffee in 40 mid-hill districts. However, organized coffee farming under the Nepal Coffee Producers Association (NCPA) is reported in 22 districts only (Karki, 2012). Among the different agricultural goods produced in and exported from Nepal, the competitiveness of coffee has quickly increased in recent years,

thus contributing to the improvement of rural livelihoods. According to the NTCDB (2014), the production of coffee parchment swelled to 536 tons in 2013/14 from 144 tons in 2003/04 (Dhakal, 2005).

In Nepal, coffee is predominately grown by resource-poor and small-scale farmers under marginal upland conditions (Shrestha et al., 2008). In most cases, coffee cultivation is using unproductive, fallow and lands prone to degradation and thus it helps to conserve soil erosion, degradation of land and also provides 20-25 percent extra income than traditional cereal crops like maize and millet (Chaudhari et al., 2008).

Coffee cultivation has an enormous potential to provide farmers with good employment and income generation opportunities, especially in the mid-hills regions where there is a huge amount of land and suitable climatic conditions for growing coffee successfully. Nepalese coffee has high demand in Japan, America, South Korea, Germany, and the Netherlands. There has been growing interest from both government and non-government sectors in promoting organic coffee and farmers are also motivated to produce coffee owing to higher demand in the international market (Tiwari, 2010).

Insect pests and diseases can significantly affect quality, yield, and cost of production. Farmers in Nepal have limited knowledge of controlling coffee insect pests and diseases. The major insects damaging coffee in Nepal are White Stem Borer (WSB) caused by *Xylotrechus quadripes*, larvae of Red Stem Borer, green scale, mealybugs, and aphids. Grasshoppers, leafhoppers, hairy caterpillars, caseworms, and tortoise beetles are also found as minor pests (Panthi, 2015). The major diseases prevalent in Nepal are Coffee leaf rust, Bacterial blight, Brown Eyespot & Berry Blotch, Phoma, and Coffee Berry Disease.

Hemileia vastatrix causes coffee leaf rust, the most important disease of coffee worldwide. It was first discovered in the vicinity of Lake Victoria in East Africa in 1861 and later identified and studied in Ceylon (Sri Lanka) in 1867. The disease soon spread to much of Southeast Asia and eventually throughout the southern, central, and western coffee-growing regions of Africa. Coffee leaf rust was not known in the western hemisphere until 1970 when it was found in Bahia, Brazil. The rust infects mainly leaves, but also young fruit and buds. Resistant varieties of coffee and fungicides are used to control the disease but have added to the cost of coffee production (Hernández, 2005).

Coffee rust was officially identified by the Plant Pathology Division, Khumaltar, NARC in Nepal in April 2015. Before this, it was reported in Nepal. It had not been noticed in areas where coffee plantations are at the commercial level (Palpa, Gulmi). But nowadays, it has become the major disease of coffee plantations. It occurs all year round, but it is severe during high temperature and high humidity (August-November). It can cause up to 70% loss of the crop. Transmission can occur through wind, water, insects, birds, animals, and even humans (Shrestha, 2010).

Coffee Leaf Rust is a very serious disease of coffee plantations that has severely affected many coffee orchards in Lalitpur and other districts in the country. Coffee farmers and stakeholders have been warned that Nepali coffee might be wiped out within a few years from now if no urgent steps are taken to protect it from the endemic coffee leaf rust disease. The disease was reported to have damaged coffee plantations in *Lalitpur, Kavre, Syangja, and Kaski* districts. The chances of the transmission of the disease in other parts of the country are equally high as the disease is transmitted through air. *Thuladurlung, Gimdi, Chandanpur, Pyutar, and Kamidanda* are the major coffee-producing village development committees (VDCs) in the Lalitpur district (Pokhrel, 2005). The study was done to know about the incidence and severity of coffee leaf rust in the major coffee production areas of Lalitpur district.

MATERIALS AND METHODS

Lalitpur district was chosen for a field survey due to its high coffee leaf rust incidence. The study focused on five major coffee-producing areas: Chandpur, Thuladurlung, Gimdi, Pyutar, and Asrang. The survey aimed to assess the disease situation in farmers' fields. Eighty farmers were randomly selected from the five VDCs and interviewed about their coffee cultivation practices and disease challenges. Data was collected through field observations, interviews, questionnaires, and secondary sources like reports, books, and journals. Demographic information such as education, family size, ethnicity, occupation, and landholding was recorded. Focus group discussions provided insights into farmers' perceptions and attitudes towards coffee cultivation.

Disease incidence was measured by counting diseased and healthy trees (100 trees per site), and disease intensity (DI) was assessed on a scale of 1 to 4 based on rust pustules per leaf. The DI formula was:

$$(n_1+n_2 \times 2+n_3 \times 3+n_4 \times 4)/(n_1+n_2+n_3+n_4)(n_1+n_2 \times 2+n_3 \times 3+n_4 \times 4)/(n_1+n_2+n_3+n_4),$$

where n represents the number of leaves in each class.

Data from primary and secondary sources were edited, coded, and analyzed using Microsoft Excel, with results presented in tables, bar diagrams, and pie charts.

RESULTS AND DISCUSSION

The total area and Coffee Cultivation Area of the respondents

The total area of all the respondents was 1775 ropani. Among them, coffee production was done in 335 ropani areas (19%). This showed that although coffee was grown as a commercial crop, still majority of the cropping area was still used for cereal crops for subsistence production.

Cropping Pattern

The cropping pattern of the farmers interviewed was diverse. Farmers who knew the diseases and their management approaches had grown shading plants like ipil-ipil, banana, etc. as border plants. Other farmers cultivated coffee with maize as a mixed crop to utilize the land and obtain extra output.

Varieties grown

The respondents when questioned about the coffee varieties used, were only able to tell us that they were local Arabica varieties. This showed that none of the farmers had exact information or were not aware about the variety of coffee grown. However, the varieties grown in the area as obtained from the organization HELVETAS are listed as:

Table 1. Varieties of coffee grown in Lalitpur

Pakamara	Katura
Pacas	Selection-10
Tekisik	Catimor
Tipika	Cabery
Katisik	Bourbon

Irrigation

The farmers of Thuladurlung and Gimdi (33) had no access to irrigation sources and thus left their land unirrigated (41.75%). Among the remaining 47 farmers, the majority of the farmers used sprinkler irrigation (82%) while some of the farmers also had installed drip irrigation systems (18%). The source of irrigation was wells and rivers.

Source of plant material used by the respondents

The majority of the respondents i.e. about 56% used planting materials from their neighbors and relatives. About 28% of the farmers used the saplings from the nursery as a planting material. The remaining 16% of the farmers buy the planting materials from the co-operatives.

Training and Pruning

Among the respondents interviewed 18.75% (15) were trained by INGOs and had the knowledge of training and pruning. The majority of the farmers i.e. 53.75% (43) randomly trained and pruned their plants as per pruning requirements. The remaining 27.5% (22) didn't train or prune their plant.

Major problems Faced by the farmers

The major problem faced by the farmers in the field was that of diseases (60%). After that, the major loss in production occurred due to insects (35%). Weeds also caused a loss in production of coffee production in small amounts (5%).

Diseases

Among the field surveyed area, the major disease was Coffee Leaf Rust (CLR) which had a disease frequency of about 80%, which was similarly followed by Brown eye spot (8%), Berry Blotch (6%), Anthracnose (2%), Brown blight (2%) and twig die-back (2%). This showed that the other diseases were only present in lower intensity and that the coffee leaf rust required immediate attention.

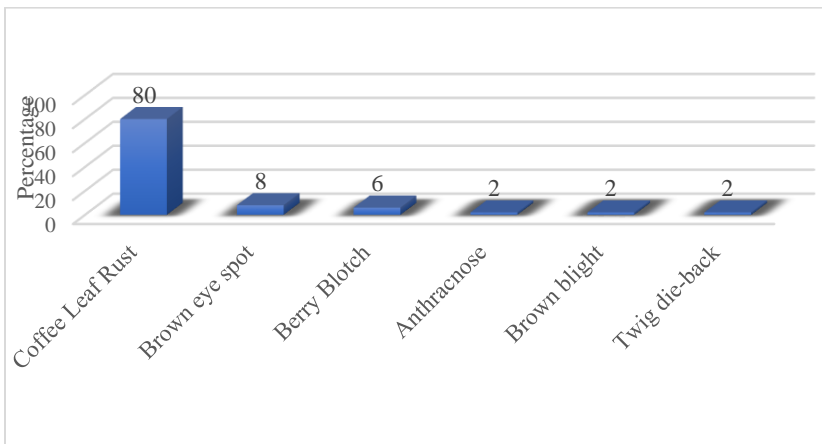


Figure 1. Major diseases of coffee in Nepal

Insect

The major insect pest affecting the locality was White Stem Borer (WSB), affecting about 91 percent of the orchards which was followed by Red stem borer (3%). Other groups of insect pests like grasshoppers, leaf miners, scale insects, rodents, birds etc. in combination had some minimal effect (6%) on production as compared to borers.

Scoring of CLR

Among the 80 respondents, the diseases frequency was found to be 75% on average.

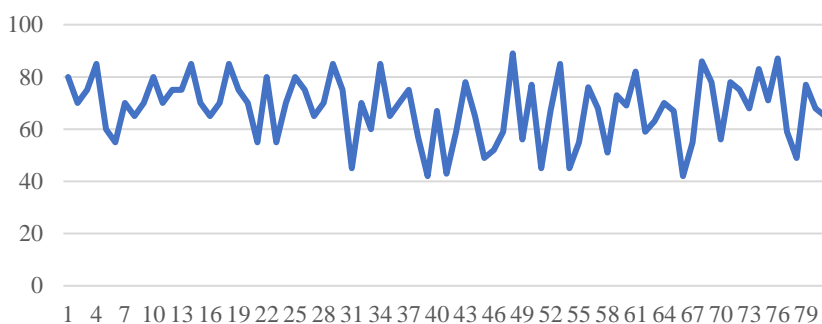


Figure 2. Disease incidence of CLR

The average disease incidence was found to be highest in Thuladurlung with a disease frequency of 71%. The lowest disease incidence was found in Gimdi VDC with a disease incidence of 57.5%.

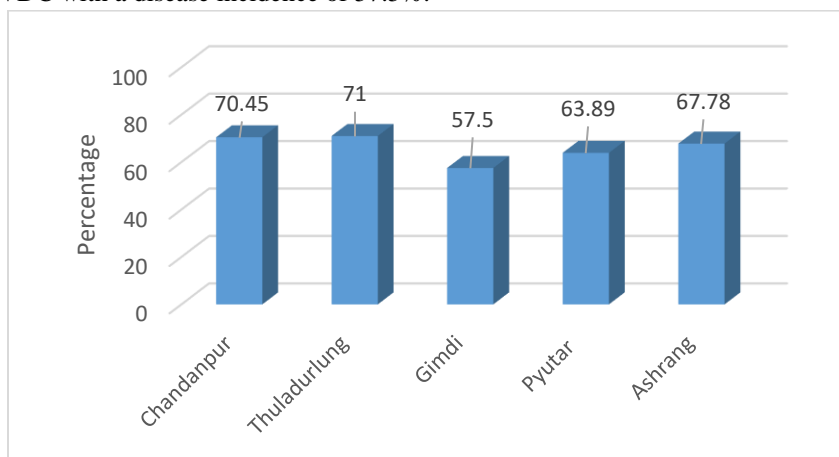


Figure 3. Disease Incidence in Different VDCs

The disease intensity (DI on a scale of 1 – 4) was based on the scale developed by Hindorf & Ritschel. The disease intensity of the farmers’ field on average was found to be 2.65.

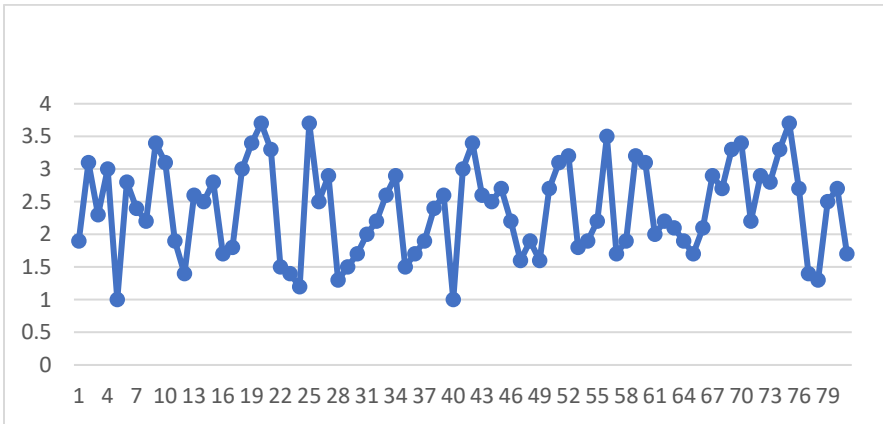


Figure 4. Disease intensity of CLR

The disease intensity was found to be similar in almost all VDCs. However, it was slightly maximum in Gimdi VDC with a score of 2.52. The lowest disease intensity was in Pyutar VDC with a score of 2.22.

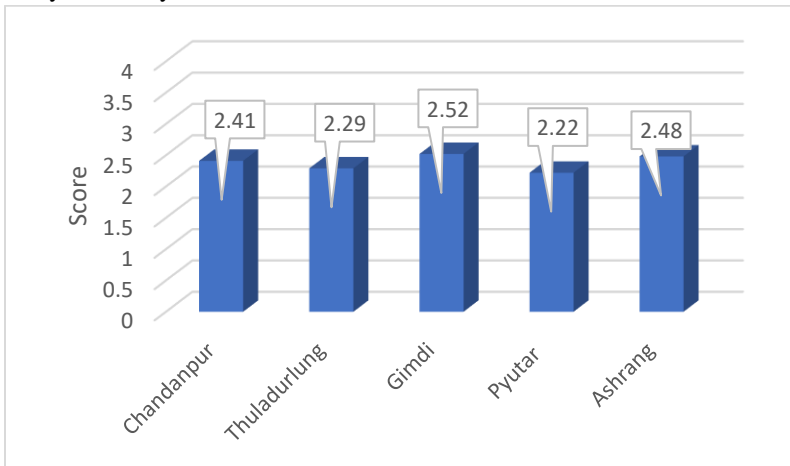


Figure 5. Disease Intensity in Different VDCs

CLR management practices adopted by the farmers

Out of the 80 respondents surveyed, seventy-nine percent of the respondents managed the CLR by using Bordeaux mixture. Eighteen percent of the

respondents used the shading effect to overcome the rust and three percent of the respondents adopted resistant varieties. Since the farmers adopted organic coffee production in the Lalitpur area, chemical pesticides were not used against Coffee Leaf Rust.

Respondent's training status on CLR management

Among the 80 respondents, some of them were found to have received training regarding the CLR management, 38 of them had got training on Coffee Leaf Rust and about remaining respondents had not received training which was conducted by HELVETAS in coordination DADO, NARC, NTCDB, and PPD.

CONCLUSION

The study showed that, there were many diseases and insect pests causing loss to the coffee plantation in Lalitpur district. Among them, Coffee leaf rust (CLR) was one resulting in severe economic losses (80%). The disease was prevalent in every season, increasing its incidence in the rainy season as well as the fruiting season. Many farmers (48%) have received training on coffee leaf rust and management techniques like growing resistant varieties, shading effect, and use of Bordeaux mixture. The disease was found to be controlled to some extent by the use of the above management practices. Still, the incidence of the disease was high, and further control measures were required. The farmers did not use any chemical pesticides in their fields as the area was an organic coffee production site. Also, botanical pesticides were not used for the management of the diseases. The farmers did not have proper knowledge of IPM practice and awareness. Also, no efforts were made to manage the incidence of white stem borers. The farmers lacked the use of organic manures in the field and there was a serious ignorance of the cultural practices. Weeding, applying nutrients, field sanitation, etc. was not proper in the coffee-cultivated fields. It revealed that there was a lack of research activities on coffee leaf rust in Nepal. Since the occurrence of this disease is very high, researchers and government officials engaged in agriculture should be encouraged to conduct more research activities on this disease, rather than depend on foreign journals and articles for disease management. The major focus of the research should be to learn about CLR epidemiology and control measures.

REFERENCES

- Acharya, B., Shiva Chandra, D., Dinesh, D. & Shyam Sundar, P. (2014) International Journal of Social Science and Humanities Research. *International Journal of Social Science and Humanities Research*. 2(4).73-78.
- Agriculture and food security (2016, April 15) U.S. Agency for international development. Available from: <https://www.usaid.gov/nepal/agriculture-and-food-security>. [Accessed: December 8, 2016].
- Arneson, P.A. (2017) Coffee rust. The Plant Health Instructor. Available from DOI:10.1094/PHI-I-2000-0718-02. [Accessed: April 16, 2017]
- Chaudhary, J. N. et al., (2008). Performance Evaluation of Coffee Genotypes in the Western Hills of Nepal. Nepal Agriculture Research Council, Khumaltar, Lalitpur.
- CoPP. (2008) Coffee Promotion Program (CoPP), Annual Report, Helvitas, Nepal.
- Crous P.W., Gams W., Stalpers J.A., Robert V. & Stegehuis. G. (2004) Myco Bank: an online initiative to launch mycology into the 21st century. *Studies in Mycology* 50. 19–22.
- Daivasikamani, S. & Naika R. (2009) Biological Control of Coffee Leaf Rust Pathogen. *Journal of Biopesticides*. 2 (1).94-98.
- Daivasikamani, S. & Naika, R. (2013). *Coffee Leaf Rust: Epidemiology, Screening and Management*. Saarbrücken. Lap Lambert Academic Publishing.
- Dhakal, B. R. (2005) *Coffee Manual*. National Tea and Coffee Development Board, Kathmandu, Nepal.
- Gotame, T.P. & Budathoki, K. (2005) *Research Needs on Coffee Enterprise Development in Nepal*. Nepal Agriculture Research Council, Khumaltar, Lalitpur.
- Hernández, J.R. (2005) *Invasive Fungi. Coffee Leaf Rust - Hemileia vastatrix*. Systematic Mycology and Microbiology Laboratory, ARS, USDA. Available from [/sbmlweb/fungi/index.cfm](http://sbmlweb/fungi/index.cfm). [Accessed May 4, 2023].
- Hindorf, H. & Ritschel, A. (2006) *Coffee Leaf Rust (Hemileia Vastatrix) In the Wild Coffee Population (Coffea Arabica) of Ethiopia*. 1st ed. Ethiopia.
- International Coffee Organization (2006) Good Hygiene Practices along the coffee chain: a training resource for coffee producing countries. Available from http://www.ico.org/projects/Good-Hygiene-Practices/cnt/cnt_en/sec_1/c02.importanceof.html. [Accessed: December 9, 2023].
- Karki, Y. K. (2012) Value Chain Development Plan for Organic Coffee. 1st ed. Kathmandu: Project for Agriculture Commercialization and Trade (PACT).
- Khadge, B. R., Dhakal, D.P., Giri, Y. P. & Aryal, S, (2004) Diseases and insect pest of coffee in Nepal. Nepal Agriculture Research Council, Khumaltar, Lalitpur.
- Kookan C. (2014) Coffee Rust Complexity. [Blog post]. Available from : <http://blog.savatree.com/2014/08/coffee-rust-complexity/>. [Accessed: April 16, 2023].
- Kushalappa, A. C. & Eskes, A. B. (1989) Coffee rust: Epidemiology, resistance, and management. Boca Raton, FL: CRC Press.

- Mudyiwa, R et al., (2017) Evaluation of Different Botanicals for the Control of Coffee Leaf Rust (*Hemileia Vastatrix* Berkeley and Broome). *International Journal of Plant & Soil Science* 14 (6): 1-8.
- Nutman, F. J. & Roberts, F. M. (1970) Coffee leaf rust. *Tropical Pest Management*, 16(4), 606–624. Doi: 10.1080/09670877009413428.
- Panthi, B. B. (2015) Small scale coffee farmer's response towards management of coffee pest through field level techniques. *Journal of Institute of Science and Technology*, 19(2). 37.doi:10.3126/jist. v19i2.13850.
- Pokhrel, Y. (2009) Coffee Cultivation: Nepal Could Make Huge Gains. *The Rising Nepal*. Available from http://www.gorkhapatra.org.np/gopa.detail.php?article_id=10665&cat_id=10 [Accessed: April 26, 2017].
- Pokhrel, Y. (2016) Coffee farmers ask govt help to control CLR. *The Rising Nepal*. Available from <http://therisingnepal.org.np/news/8623>. [Accessed: December 8, 2016].
- Shrestha B.K. & Pathak R.P. (2010) *Organic Coffee Manual*, HELVETAS Swiss Corporation Nepal, Bakhudol, Lalitpur.
- Shrestha P.M. & Mishra R. (2014) *Coffee Production in Nepal: Constraints and Opportunities*, CoPP, HELVETAS.
- Shrestha, P. M., Sharma P. & R. Mishra (2008) *Production, Processing and Marketing of Coffee in Nepal*. NAST, NARC and NHS, 2009. Proceedings of The Fifth National Seminar on Horticulture, National Academy of Science and Technology (NAST), Nepal Agriculture Research Council (NARC) and Nepal Horticulture Society (NHS), Kathmandu.
- Thapa, K.B. et al., (2011) Effect of Organic Manure and Chemical Fertilizer Application on Fresh Cherry Production of Coffee. Proceedings of the 7th National Horticulture Seminar.
- Tiwari K.P., (2010) *Agricultural Policy Review for Coffee Promotion in Nepal*, Gulmi. *The Journal of Agriculture and Environment*.11.138-139.
- Waller, J. M., Bigger, M. & Hillocks, R. J. (2007) *Coffee Pests, Diseases and Their Management*. 1st ed. Wallingford, UK: CABI Pub.