

ADOPTION OF SUSTAINABLE MANAGEMENT PRACTICES OF CITRUS FRUIT FLY IN MYAGDI DISTRICT, NEPAL

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ABSTRACT

Citrus fruit fly infestation poses a significant threat to citrus farming in Myagdi district, Nepal, affecting the productivity and sustainability of the crop. This study aimed to explore factors influencing the adoption of sustainable management practices for controlling this pest. Conducted across three municipalities, primary data were collected from 100 households through a pre-tested questionnaire and analyzed using STATA version 15. The binary logistic regression model revealed that extension support and household income were significant positive factors for adopting sustainable practices, while distance from the nearest market had a significant negative impact. Other factors, including age, gender, training, knowledge index, education, and organizational involvement, were not significant. These findings highlight the need to prioritize extension support, improve market access, and enhance household income in policies and programs promoting the adoption of sustainable management practices. For extension workers, this entails focusing outreach efforts on households located farther from markets and those with lower incomes, as these factors present significant barriers to adoption. This study provides insights for developing effective policies and strategies to address citrus fruit fly challenges.

Key words : Adoption, citrus fruit fly, sustainable management practices

INTRODUCTION

The production of citrus fruits is very popular in the mid-hills of Nepal, which contributes 21.6 percentage of the country's fruit production (MoALD, 2023). Among citrus, mandarin (*Citrus reticulata* Blanco) cultivation covers a productive area of 19,481 ha, producing 185,346 mt (MoALD, 2023). Myagdi is a prominent mandarin producing district in western Nepal with 389 ha of productive orchard land. However, its productivity stands at 8.62 mt per ha, which is slightly lower than the national average, i.e., 9.51 mt per ha (MoALD, 2023). This lower productivity could be attributed to poor management practices, fruit fly infestation, fruit drop, and poor post-harvest management practices (Acharya & Shrestha, 2021; Pandey, 2022).

The Chinese citrus fly (*Bactrocera minax*) is a significant citrus pest in Nepal, India, Bhutan, and China (Adhikari et al., 2020). Fruit flies directly harm fruits and vegetable-fruits, resulting in a yield loss of up to 90–100% (Sharma et al., 2015). To control the detrimental effects of this pest including other impacts, various private and public organizations are consistently attempting to promote the

environmentally sustainable management practices to farmers. Despite this, the producers are not participating to adopt this technology as expected. Furthermore, literature investigating this knowledge gap is also very rare. This study aims to explore and identify the factors influencing the adoption of these sustainable practices, focusing on extension services, household income, and market proximity. Understanding these factors is crucial to addressing the barriers to adoption and developing effective strategies for improving adoption rates.

MATERIALS AND METHODS

Study site and design

The study was conducted in 2023 in Beni municipality, Mangala rural municipality and Annapurna rural municipality of Myagdi district, as these areas had significant citrus production. The citrus fruit fly infestation was also severe in these locations. A simple random sampling technique was used to select 100 respondents from a list of 128 farmers available at the Prime Minister Agriculture Modernization Project (PMAMP), Project Implementation Unit (PIU), Citrus zone office, Myagdi. The questionnaire was pretested with ten farmers (two from Beni, three from Annapurna and five from Mangala municipality) to finalize the questionnaire before administering it to the respondents.

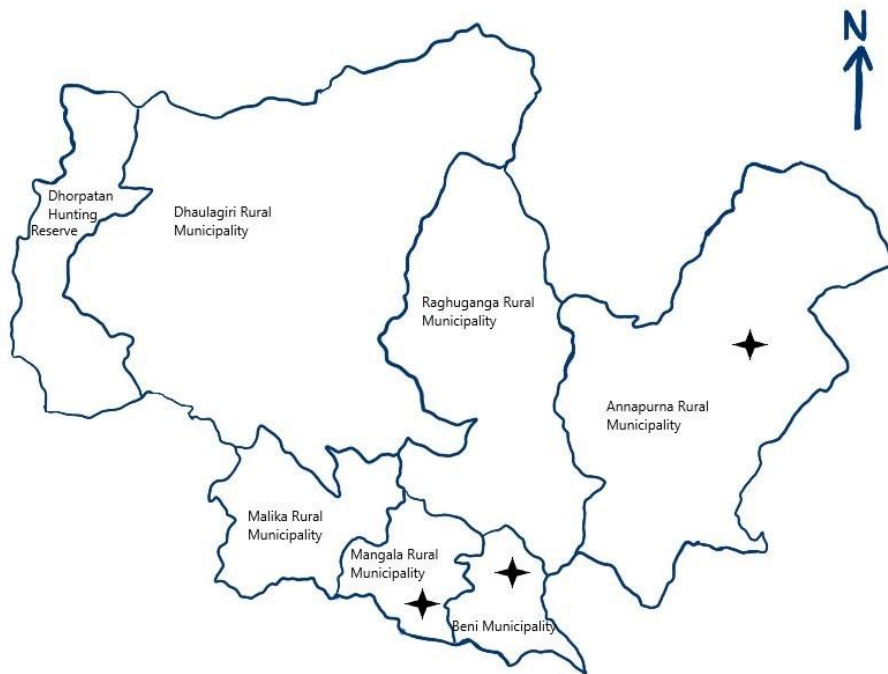


Fig. 1. Map of Myagdi district showing the study area.

Data collection and statistical analysis

Questionnaire was prepared and pretested then with the help of a pre-tested questionnaire household survey was conducted and primary data was collected including socio-demographic and institutional

information. Secondary data were collected from publications and database of PMAMP, Agriculture Knowledge Centre, as well as various others publication tools such as books, journals, proceedings, etc. For the reliability of data collected focus group discussion and key informant interviews were also conducted. The information collected was first coded, entered and tabulated into the computer then data analysis was done using computer software packages STATA version 15 and MS-Excel. Binary logistic regression model was used to determine the combined impact of various independent variables on the level of sustainable practice adoption (Table 1).

The logistic regression model can be mathematically represented in the following way:

$$Y_i = \beta_0 + \sum_{i=1}^{i=11} \beta_i X_i$$

Where: Y = Adoption Index

β_0 is the intercept or the constant term.

The coefficients (β_1 to β_{11}) correspond to various independent variables

Table 1. Independent variables and their expected effect

Coefficient	Independent variable	Expected effect
β_1	Gender (0, 1)	-
β_2	Age	-
β_3	Extension support	+
β_4	Training	+
β_5	Knowledge index	+
β_6	Commercial citrus cultivation experience (years)	+
β_7	Education	+
β_8	Distance to the nearest market (km)	-
β_9	Member involvement in organization (0, 1)	+
β_{10}	Ratio of citrus cultivated data to total owned land	+
β_{11}	Income	+
β_0	Constant	

RESULTS AND DISCUSSION

Socio-demographic characteristics of respondents

Table 2 presents the socio-demographic characteristics of the respondents. Of the total surveyed households, 75% were headed by males, while 25% were headed by females. The age distribution shows that 60% of respondents were between 39 and 65 years old, 25% were above 65 years old, and 15% were below 39 years old. Regarding income sources, 80% of respondents reported agriculture as their primary livelihood, while 15% depended on remittances, 3% on business, and 2% on government services.

Table 2. Socio-demographic information of the respondents

Gender	Frequency
Male	75
Female	25
Total	100
Age group(years)	Frequency
<39	15
39-65	60
>65	25
Total	100
Mean	52.44
Standard Deviation	13.57
Source of income	Frequency
Agriculture	80
Remittance	15
Business	3
Service	2
Total	100

Factors determining the adoption of sustainable management practices

Table 3 presents an analysis of the factors influencing the adoption of sustainable management practices for citrus fruit fly control in Myagdi, Nepal. The three sustainable practices considered were sanitation of the orchard, bury infested fruit at least 50 cm below ground and use of protein bait.

Extension services

The result shows that extension services significantly and positively influence adoption (coefficient = 0.081, $p = 0.028$). This suggests that households with greater access to extension services are more likely to adopt these practices. For every unit increase in extension support, the likelihood of adoption increases by 8.1%. This aligns with Poudel et al., (2021), who reported that higher extension boosted management practice uptake. Similarly, Poudel et al., (2020) reported that mandarin farmers with more frequent interaction with extension services showed greater levels of adoption. This is probably because of the spread of expertise knowledge to local farmers and the positive influence and attitude it generates. Poudel et al., (2023) and Kumar et al. (2017) also reported similar results.

Income

Income of the respondents also plays a significant role in adoption, with a coefficient of 0.114 and a p -value of 0.023, indicating a positive correlation between income and the adoption of sustainable practices. A unit increase in household income leads to an 11.4% increase in the probability of adopting sustainable practices. This suggests that higher-income households are more financially capable of adopting these practices. This finding is supported by Poudel et al. (2021), who found that farmers with higher agricultural income were better able to afford management practices. However,

this contrasts with Poudel et al. (2020), who found no significant association between income and adoption.

Distance to the nearest market

The distance to the nearest market significantly impacts the adoption of sustainable practices ($p = 0.000$). The negative coefficient of -0.098 suggests that for every additional kilometer a household is from the nearest market, the probability of adopting sustainable practices decreases by 9.8%. Households closer to markets benefit from better access to inputs, extension services, and information, making it easier to adopt sustainable practices. This result is supported by Liu et al. (2018), who found that proximity to markets is crucial for adopting best management practices. However, our findings contrast with Dahal et al. (2023), which indicated that adoption likelihood increased with greater distance to markets, potentially due to farmers traveling to larger markets when local retailers did not provide sufficient inputs at reasonable prices.

Insignificant variables

Other factors, including gender, age, training, knowledge index, commercial citrus cultivation experience, education, membership in organizations, and the ratio of citrus cultivation to total owned land, did not have statistically significant effects on the adoption of sustainable practices. These variables may not play as direct a role in adoption decisions as factors like income, market access, and extension support in this context.

Table 3. Factors determining the adoption of sustainable management practices for citrus fruit fly management in Myagdi, Nepal

Variable	Coefficient	Standard error	t	p- value
Gender	-0.030	0.094	-0.33	0.746
Age	-0.000	0.003	-0.14	0.892
Extension support	0.081	0.036	2.23	0.028*
Training	0.038	0.024	1.58	0.119
Knowledge index	-0.053	0.034	-1.55	0.124
Commercial citrus cultivation experience	0.022	0.038	0.73	0.470
Education	-0.016	0.025	-0.63	0.529
Distance to the nearest market	-0.098	0.009	-9.96	0.000**
Member involvement in organization	0.130	0.090	1.44	0.154
Ratio of citrus cultivated land as compared to total owned land	0.200	0.124	1.61	0.110
Log Income	0.114	0.049	2.31	0.023*
Constant	1.367	0.669	2.04	0.044
Prob>F	0.000			
R- squared	0.868			
Adj R-squared	0.851			
Root MSE	0.365			

Note: * and ** indicate significance at 5% and 1% level respectively

Extension services, income, and market proximity significantly influence the adoption of sustainable practices for citrus fruit fly control in Myagdi, Nepal. Key actions include farmer training, promoting eco-friendly practices, improving access to inputs, strengthening institutional support, encouraging community-based approaches, aligning policies with Integrated Pest Management (IPM), and ensuring continuous monitoring and adaptation. These coordinated efforts aim to reduce pest impact while promoting long-term environmental and economic sustainability. Further research is needed to understand adoption dynamics better.

CONCLUSIONS

This study highlights that extension support and household income are key drivers of adoption of sustainable management practices for citrus fruit flies in Myagdi, Nepal. Farmers with access to extension services and higher incomes are more likely to adopt these practices. In contrast, distance from markets poses a barrier, reducing adoption rates. These findings suggest that enhancing extension services, boosting farmer incomes, and improving market access should be priorities for policymakers to effectively promote sustainable agricultural practices in the region.

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