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KNOWLEDGE AND APPLICATION OF GOOD AGRICULTURAL PRACTICES (GAPs) BY MANDARIN GROWERS OF JAJARKOT, NEPAL

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ABSTRACT
A study was conducted to determine the level of knowledge and factors influencing awareness of Good Agriculture Practices among mandarin growers in Jajarkot, Nepal. For data collection, 60 commercial mandarin producers were interviewed using pre-tested semi-structured questionnaires. Based on their knowledge of GAP, the farmers were divided into two groups: GAP aware and GAP unaware. The data were analyzed using statistical tools such as binary logistic regression, t-test, and chi-square test. The results revealed that less than half of the respondents were aware of the Mandarin GAP. GAP linked to waste management was embraced by the majority of respondents, whereas GAP related to documents and records was determined to be the least adopted of the 10 standards. The t-test result showed a significant difference in dependency ratio between GAP aware and GAP unaware respondents. Similarly, number of bearing trees was significantly different between GAP aware and GAP unaware respondents. The Chi-square test revealed that training had a significant relationship with GAP awareness. The binary logit model's result indicated that education level and experience in mandarin farming have a substantial impact on GAP awareness. Lack of plantation material, followed by illness and insects, a lack of knowledge of new production techniques, lower productivity, a lack of subsidies, and a lack of insurance were the main production issues. Hence, subsidies and crop insurance must be provided to the farmers and GAP awareness programs and training are required to boost mandarin output.

KEY WORDS
Awareness, GAP, mandarin, problem, training.

Citrus fruits are cultivated all over the world in tropical and sub-tropical regions where there are suitable soil and climatic condition(Savita & Nagpal, 2012). In Nepal, the climatic condition of mid hills, having an altitude of 800 to 1400m from east to west of the country, is considered favorable for all types of citrus fruit cultivation (Paudyal et al., 2016). Citrus accounts for almost 32%, with mandarin contributing about 21% of the total fruit area in Nepal (Belbase et al., 2020). Mandarin (*Citrus reticulata* Blanco) is the most important fruit in Nepal, ranking first in the total fruit business (APP, 1995). Commercial cultivation of mandarin has started in 42 mid-hill districts with the potential for further expansion in 18 more districts (NARC, 2017). Jajarkot is one of the potential districts of Nepal for mandarin production, with a total area coverage of 164 ha, productive area of 1674mt, and productivity of 10.3 mt/ha (MOALD, 2020). Mandarin cultivation serves the majority of farmers in Jajarkot's rural districts as their sole source of income, but diseases, pests, and poor cultivation practices have reduced the orchards' lifespan and productivity to just half (MOALD, 2020).

The Food and Agricultural Organization of the United Nations (FAO) defines good agricultural practice as "a collection of principles to apply for on-farm production and post-production processes resulting in safe and healthy food and non-food agricultural products and taking into account economic, social and environmental sustainability." As stated by FAO of the United Nations, the basic foundation of GAP stands on the four pillars: Economic Viability, Social Acceptability, Environmental Sustainability, and Food Safety and Quality

(MOAD, 2015). The integration of modern production methods, such as Integrated Pest Management (IPM), Integrated Crop Management (ICM), and Integrated Nutrient Management (INM), for the commercial production of agricultural products, is the foundation of efficient agricultural practices. The development and adoption of GAP have become increasingly important with ever-expanding regional and international trade in food and other agricultural products and the growing consumer consciousness regarding quality, safety, and hygiene (Chan, 2016). With a rapidly changing world and various effects such as expanding population, scientific discoveries, new technology, changing agricultural methods, changing hazards such as more resistant risks, and changes in lifestyles around the world, there is a greater need to examine and address the increasing possibility for food safety issues (Sareen, 2016).

The SAARC-GAP program, developed by FAO in the SAARC countries, incorporated Nepal in its scope (Arun & Luitel, 2018). In 2011, the Government established the GAP technical committee under the Ministry of Agriculture and Livestock Development (MOALD) and later set up the GAP technical sub-committee in its three departments for respective tasks (DOA, DOLS, and DFTQC) in 2013 (GC, 2015). As the first crucial step toward ensuring food safety and facilitating commerce, MOALD prepared Nepal GAP implementation directions in 2018 (Joshi et al., 2019a). Nepal GAP implementation directives have established five modules; Food Safety Module, Environment Management Module, Produce Quality Module, Worker's Health, Safety, and Welfare Module, and General Requirement Module, based on the standards of SAARC GAP (MOAD, 2015).

Nepal GAP has a total of 243 requirements categorized into critical, major, and minor. The Requirements under “Critical” needs a 100% compliance rate, and those under the “Major” and “Minor” categories need at least a 90% and 50% compliance rate (Arun & Luitel, 2018). A planting material shall be free of visible signs of pests and disease. In the case of in-house propagation, only quality rootstock and scion material are used. Alternatively, propagation material should source from a certified nursery (government / private nurseries / agricultural institutions / accredited tissue culture laboratories) (MOAD, 2015). The size of the pits should be one cubic meter, and the seedlings should be transferred into a nursery bed at a distance of 45–60 cm by 20–30 cm after 6–9 months. When filling the pit, 25–30 kg of thoroughly decomposed FYM and 20–30 grams of lime should be added (Acharya et al., 2011). A document that guarantees seed quality (free from injurious pests, diseases, and viruses) should be present on the farm (MOAD, 2015). There must be no dangerous pollutants in the water used for irrigation or fertigation. Direct placement of the harvested product on the ground or the floors of the handling, packing, or storage rooms is not permitted. Produce must be kept and moved separately from items that could be a source of chemical, biological, or physical contamination (MOAD, 2015). Farmers and employees must receive enough training in the GAP-related areas of their responsibilities, and training records must be maintained (MOAD, 2015). The Nepali farming system is mainly composed of marginal farmers, described as one having few resources, little access to government services, and are uneducated. In light of this, implementing Nepal GAP is difficult since managing agricultural data requires a lot of time and effort (Arun & Luitel, 2018). Additionally, GAP requirements are complicated, challenging developing nations to enter importing markets but also offering opportunities for advancement (Pandey et al., 2018).

The yield from mandarin farming has not yet lived up to the expectations of farmers in Jajarkot (Sharma et al., 2020), despite the government's development of GAP standards for fruits and vegetables and the time and effort devoted by farmers. The extent of GAP adoption and the variables influencing adoption in Jajarkot have not been investigated. According to Rogers, (2010), raising GAP awareness is the first step in adopting new technology. This study examined the numerous factors affecting GAP awareness to offer instructions and guidance to interested institutions, organizations, and stakeholders. This study determined the state of the mandarin orchard management in Jajarkot and discovered the discrepancy between farmer and good agricultural practices.

MATERIALS AND METHODS OF RESEARCH

The study was conducted in the command area of the Prime Minister Agriculture Modernization Project (PMAMP), Project Implementation Unit (PIU) Citrus Zone, Jajarkot during April/May 2021. The study areas were in Bheri Rural Municipality, Nalagad Municipality, and Kushe Rural Municipality, selected purposively based on area coverage of mandarin, the number of mandarin growing farmers, production of citrus, and access to road facilities in Jajarkot district.

A list of commercial mandarin growers was obtained from PIU (Citrus Zone) and Agriculture Development Office (ADO), Jajarkot. The list was used as the sampling frame to select the respondent farmers and the sampling size was determined by using the Rao-soft sample size calculator. The interview was carried out with 60 farmers, from Bheri Rural Municipality (n=11), Kushe Rural Municipality (n=39), and Nalgad Municipality (n=10).

The interview schedule was prepared, referring to the standard of GAPs for fruits and vegetables by FAO and Nepal GAP, and a checklist. This was used to collect information from the randomly selected mandarin growers of the citrus zone about the household, socio-economic status, knowledge of GAP, the extent of GAP adopted, and factors affecting GAP. Two comprehensive FGDs were conducted in the study area after completing the household survey. The secondary data related to mandarin production were obtained from publications of PM-AMP Citrus zone, Agriculture Development Office (Jajarkot), Central Bureau of Statistics, Fruit Development Directorate, and Food and Agriculture Organization. Articles, proceedings, research papers, and websites of various national and international journals and universities were also used.

The collected information was analyzed using IBM SPSS Statistics Software (version 26), Microsoft Excel 2016, and Stata Statistical Software (version 17). Means, standard deviation, frequencies, and percentages were computed using descriptive statistics. Data were further analyzed using an independent sample t-test, chi-square test, and Binary Logit Regression Model. The spelling mistake, missing information, overlapping responses, and other invalid responses were checked using the descriptive statistic in SPSS, and appropriate corrections were made.

Descriptive statistics such as frequency count, percentage, mean, and standard deviation were used to describe socioeconomic and farm characteristics of the respondents, such as family size, age, occupational pattern, education level, land holding size, livestock standard unit, economically active population, and adoption of good agricultural practices. The farmers were categorized into two groups: Aware of GAP and Unaware of GAP. The data analysis and comparisons were made on these categories to derive results as shown in Table 1.

Table 1 – Parameters for categorization of GAP aware and unaware farmers

Parameters	Criteria to be GAP aware
Planting materials	Must be certified and disease free
Plantation method	Must dig pit of $1m^3$
Soil management and fertilization	Must apply FYM and chemical fertilizers about 75% to 125% of recommended dose
Water management	Must irrigate orchard at least in 3 stages: new growth and flowering, fruit setting and early stage of fruit growth if the soil is dry and must manage drainage system
Crop protection	Must integrate IPM system and must use registered pesticides only
Other management practices	Must carry out training pruning and weeding practices
Harvest and on-farm processing and storage	Must consider maturity indices, use ladder crates, bags during harvesting and must sort and grade fruits and store fruits in appropriate environment after harvesting
Hygiene and environmental management	Safe disposal of pesticides containers, separate decomposable and non-decomposable wastes and minimize non-recyclable wastes
Human welfare	Must provide decent wages and appropriate working hours
Document and records	Must maintain records of farm

Source: Nepal GAP checklist.

The United Nations Food and Agriculture Organization's GAP framework for fruits and vegetables was utilized as a baseline for measuring the amount of GAP adoption by mandarin farmers. The percentage of GAP applications was calculated using descriptive statistics. Planting materials, plantation, soil management, fertilization, water management, crop protection, other cultural operations, harvest, and on-farm processing and storage, hygiene and environmental management, human welfare, and document and records were all investigated.

A binary logit regression model was used to investigate the characteristics that influence GAP awareness among mandarin growers. The dependent variable was GAP awareness, while the independent or predictor variables were sex, age, education, household size, farm size, and experience with mandarin farming. GAP awareness among mandarin growers= f (sex, age, education, household size, farm size, and experience on mandarin farming)

The dependent variable for this study was farmers' awareness or unawareness of GAP with a value of 1 if farmer is aware of GAP) and 0 (if farmer is unaware of GAP). The logit model predicts the logit of the dependent variable (awareness of GAP) from independent variables. The likelihood of farmers being aware of GAP is predicted by odds (y=1); that is the ratio of the probability that Y equals to1 to the probability that Y not equals to 1:

$$\text{Odd } Y = P(Y=1)/ (1-P(Y=1))$$

The logit (Y) is given by natural log of Odds:

$$\ln [p(Yi=1)/ (1-p(Yi=1))] = \log \text{odds} = \text{Logit}(Y)$$

This can be expanded as:

$$\text{Logit}(Y) = \alpha + \sum \beta_1 X_1 + \sum \beta_2 X_2 + \sum \beta_n X_n + \varepsilon_i$$

Where: Y= dependent variable (awareness) with 1= aware and 0= otherwise; α = intercept; εi= error index; $\beta_{1.....}$ β_n= coefficient of independent variables; P (p) = probability of being aware of GAP; 1-p= probability that a farmer is not aware of GAP, ln= natural log.

Table 2 – Description of variables used in Binary Logit Regression Model

Variable	Type	Description	Value
Dependent variable			
Awareness of GAP (Y)	Dummy	Farmer is aware or unaware of GAP	1if aware, 0 if unaware
Independent variables			
Gender(X_1)	Dummy	Gender of the respondent	0 if male, 1 if female
Age(X_2)	Continuous	Age of the respondent	Years
Education(X_3)	Continuous	Education status of respondent	Years
Household size(X_4)	Continuous	Household size of respondent	Persons
Farm size(X_5)	Continuous	Total farm size of respondent	Square Meter
Experience on mandarin farming(X_6)	Continuous	Experience of apple farming of respondent	Years

RESULTS AND DISCUSSION

Out of 60 respondents, only 43.33% respondents were aware while 56.67% were unaware about good agricultural practices.

GAP aware respondents were on average 44.46 years old with a household size of 5.96, whereas GAP unaware respondents were on average 44.24 years old with a 6.5 average household size, higher than the national average household size of 4.9 (CBS, 2014). Most of the GAP-aware respondents were female. Table 3 shows that the average number of economically active members in the research area was 2.88 and 3.56 for GAP aware and unaware respondents, respectively, with dependency ratios of 1.36 and 0.96 for the two categories. According to table 3, the average land holding was 8841.8 sq. meters and 10,367 sq. meters for GAP aware and unaware respondents respectively, with a

cultivated area of 7513.9 sq. meters and 8007.5 sq. meters of the land of HH of respective category. GAP-aware respondents had 291.30 and 37.5, while GAP unaware respondents had 195.38 and 73.19 average number of bearing and non-bearing trees respectively. The average price was about Rs. 54 for both aware and unaware respondents.

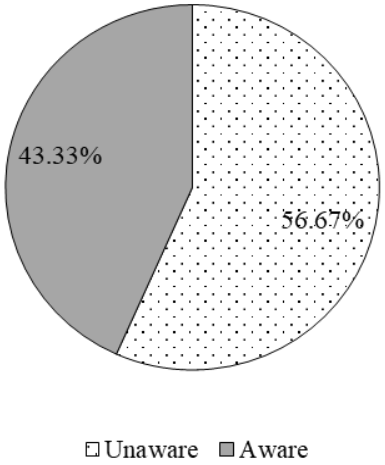

Figure 1 – Awareness on GAP (Source: Field Survey, 2021)

Table 3 – Distribution of the socio-economic and demographic characteristics (continuous variable) of the sampled household with farmers' category

Variables	Overall (n=60)	Farmers' category		Mean difference	t- value
		GAP aware (n=26)	GAP unaware (n=34)		
Age	44.33(9.43)	44.46(11.35)	44.24(7.83)	0.226	0.0914^{ns} (p=0.463)
HH size	6.27(2.29)	5.96(2.05)	6.5(2.46)	-0.538	-0.9^{ns} (p=0.81)
Male members of HH	3.03(1.48)	2.92(1.26)	3.12(1.65)	-0.194	-0.50^{ns} (p=0.691)
Female members of HH	3.30(1.55)	3.19(1.41)	3.38(1.67)	-0.190	-0.466^{ns} (p=0.679)
Economically active members	3.27(1.67)	2.88(1.37)	3.56(1.83)	-0.674	1.57^{ns} (p=0.94)
Dependency ratio	1.13(0.71)	1.36(0.83)	0.96(0.55)	0.392	2.194^{**} (p=0.02)
Total land holding (square metre)	9706.7(5896.2)	8841.8(5463.84)	10,367(6206.59)	-1525.2	-0.993^{ns} (p=0.84)
Total cultivation land (square metre)	7793.85 (4929.66)	7513.9(5143.33)	8007.5(4827.91)	-493.6	0.38^{ns} (p=0.647)
Number of bearing trees	236.95(344.11)	291.30(506.85)	195.38(113.95)	95.925	1.497^{*} (p=0.07)
Number of non-bearing trees	53(92.30)	37.56(31.02)	73.19(134.49)	-35.633	1.072^{ns} (p=0.144)
Price/kg	53.5(5.92)	53.46(5.05)	53.53(6.57)	-0.679	-0.044^{ns} (p=0.52)

*Notes: Figures in parenthesis indicate standard deviation; p-values are the result of t-test, **, * indicates 5%, 10% level of significance respectively.*
Source: Field Survey, 2021.

From the table, the dependency ratio was found significant at 5% level of significance and number of bearing trees was found significant at 10% significance.

Gender, ethnicity, and educational status responses were gathered and summarized in table 4. GAP-aware people were 65.38 percent male and 34.62 percent female in the research area, whereas GAP-unaware people were 75.53 percent male and 26.47 percent female.

The group was divided into the Brahmin/Chhetri, Janajati, and Dalit ethnic groups. The majority of GAP-aware respondents were Brahim/Chhetri in ethnicity. The adoption and spread of new technology are significantly influenced by education. There were seven groups based on the education level. Those who cannot read or write are considered

illiterate. Literate people are those who can just read and write. Primary levels refer to those who have completed formal education up to five classes, lower secondary refers to those who have completed formal education up to eight classes, secondary refers to those who have completed formal education up to ten classes, +2/certificate for schooling up to twelve classes, and university refers to those who have completed at least a bachelor's degree as shown in Table 4.

Table 4 – Distribution of the socio-economic and demographic characteristics (categorical variable) of the sample households with farmer's category

Variables	Overall (n=60)	Farmers' category		Chi-square value
		GAP aware (n=26)	GAP unaware (n=34)	
Gender of respondents				
Male	42	17 (65.38)	25 (73.53)	0.4654^{ns} (df=1,p=0.495)
Female	18	9 (34.62)	9 (26.47)	
Ethnicity				
Brahmin/ Chhetri	1	18 (69.23)	16 (47.06)	2.9496^{*} (df=1,p=0.086)
Janajati	3	8 (30.77)	18 (52.94)	
Dalit	0	0 (0.0)	0 (0.0)	
Education status				
Illiterate	5	1 (3.85)	4 (11.76)	8.5096^{ns} (df=6,p=0.179)
Literate	6	2 (7.69)	4 (11.76)	
Primary	13	3 (11.54)	10 (29.41)	
Lower secondary	15	6 (23.08)	9 (26.48)	
Secondary	13	8 (30.76)	5(14.71)	
+2/ certificate	7	5(19.23)	2(5.88)	
University	1	1 (3.85)	0 (0.0)	

*Note: Figures in the parenthesis indicate percent, * indicates 10% level of significance.*
Source: Field survey, 2021.

The ethnicity was found to have significant association with the GAP awareness at 10% level of significance.

Training was found to have significant association with GAP awareness at 5% level of significance which is in line with (Joshi et al., 2019b). Among 26 respondents who were GAP aware 68% took training from zone and ADO while only 32% of GAP aware took no such training as shown in Table 5.

Table 5 – Access to training with farmers' category

Access to training	Overall (n=100)	Farmers' category		Chi-square value
		Aware (n=26)	Unaware (n=34)	
Yes	26 (52.0)	17 (68.0)	11 (36.0)	2.9496** (df=1p=0.011)
No	24 (48.0)	18(32.0)	9 (64.0)	

*Note: Figures in parenthesis indicate percentage, ** indicates 5% level of significance.*
Source: Field survey, 2021

Better extension services and training in advanced manufacturing technology are required for the greater adoption of innovations (Kunwar et al., 2015).

Out of 60 respondents, 15% of commercial citrus growers used seed, 41.67% used grafted seedlings, and 43.33% used both seed and grafted seedlings as planting material. However, only 25% and 85% of the respondent farmers used certified planting materials and disease-free materials. In addition, 71.61% of commercial mandarin growers dug a pit of one cubic meter for transplanting, and 46.67% cultivated citrus on the relative slope with proper orientation facing north.

Likewise, all respondents used recommended dose of FYM to grow mandarin; however, only 10% of 60 respondent farmers used a recommended dose of chemical fertilizer. All the orchards had established irrigation facilities either through sprinkle or ring irrigation, the source of water was from the perennial springs, untreated sewage, and water

canals, while only 58.33% used treated water for irrigating. Moreover, 75% of respondents had used mulching, while all the respondent farmers did training- pruning and weeding.

Furthermore, all respondents harvested mandarin manually due to the short stature of the trees; however, only 55% considered maturity index before harvesting, 46.67%% of them sorted and graded fruits, and 50% of respondents stored in a clean container. Similarly, 75% of the respondent farmers managed their farm waste by various means while 25% did not adopt any methods. Out of 75% of the respondents who managed their farm waste, 11.67% burned, 21.67% dumped it in a pit, 25% fed livestock and 16.67% used waste as manure. Out of 60 respondents, 41.67% of farmers paid decent wages, while 51.67% of them only defined work as acceptable working hours. Besides, 41.67% out of 60 respondent farmers keep any form of records.

The awareness of GAP depends on a variety of factors, including socio-demographics and mandarin cultivation experience. The study investigated the effect of such independent variables on GAP awareness. Diagnostic tests were run before the regression to rule out the problem of multi-collinearity in the independent variable. VIF was determined to be 1.205 on average. There was no significant connection between any of the independent variables, indicating that multi-collinearity was not an issue.

Table 6 shows the results of a binary logit regression model used to determine the most important parameters influencing farmers' GAP awareness. Five independent variables were employed in the regression analysis using the logit model, two of which were statistically significant. Education and mandarin cultivation experience had a significant effect on GAP awareness at the 5% and 10% levels of significance, respectively, among the independent factors. The finding contradicted with Laosutsan et al., (2019), in which the experience had no significant effect on GAP awareness . Srisopaporn et al., (2015) revealed that farmers who have attended school are more qualified to understand the motivation behind Q-GAP activities and can adhere to the program's standards and record-keeping requirements.

Table 6 – Binary Logit Regression Results

Determinants	GAP aware(1=Yes)			
	dy/dx	Odd ratio	Z	p>|z|
Gender(0=Male, 1=Female)	0.067(0.158)	1.311(0.838)	0.42	0.671
Age(Years)	-0.002(0.01)	0.990(0.040)	-0.26	0.796
Education(Years)	0.047(0.021)	1.214(0.105)	2.25	0.024**
Farm size(ropani)	-0.019(0.154)	0.926(0.058)	-1.23	0.219
Mandarin cultivation experience (Years)	0.034(0.018)	0.926(0.083)	1.87	0.061*
Summary Statistics				
Number of observation	60			
LR Chi^2	12.83**			
Log likelihood	-34.64			
Pseudo R^2	0.16			

*Note: Figures in parenthesis indicate standard error, **, * indicates 5% and 10% level of significance respectively and dy/dx is marginal effect after logit.*

Here the model's Chi square value(X^2) of 12.83 and log likelihood ratio of -34.64 indicates that all the variables in the model significantly influence the probability of adoption of GAP at 5% level of significance. The pseudo R^2 value of 0.16 indicates that about 16% of decision to adopt GAP is governed by tabulated variables i.e. the model fits 16.0% to the given data.

The study revealed that powdery mildew was the major problem in the study area. A similar result was found in Parbat district (Prasad & Chandra, 2019). Out of total respondents, 36.25% of respondents marked powdery mildew as a highly problematic, canker as a moderately problematic (53.33%), and scab as a low problematic disease in comparison to other diseases as shown in Table 7.

The study revealed that the fruit fly was the major insect in the study area. A similar finding was found in Sankhuwasabha district (Rai et al., 2022). Out of 60 respondents, 35

marked fruit flies as the most damaging insects followed by an aphid and green stink bug. 61.67% of the respondents marked green stink bug to cause moderate problems, while 53.33% of the respondents marked leaf miner to cause lower damage.

Table 7 – Major diseases of mandarin in study area

Disease severity	Powdery mildew	Foot rot	Scab	Greening	Citrus canker
High	27(45)	20(33.33)	4(6.67)	18(30)	21(35)
Moderate	30(50)	23(38.33)	20(33.33)	20(33.33)	32(53.33)
Low	3(5)	16(26.67)	29(48.33)	20(33.33)	6(10)
No	0(0.00)	1(1.67)	7(11.67)	2(3.33)	1(1.67)

Note: Figures in parentheses indicate percentage.

Table 8 – Major insects of mandarin in the study area

Insect severity	Green Stink bug	Fruit fly	Aphid	Leaf miner	Mealy bug
High	18(30)	35(58.33)	26(43.33)	8(13.33)	9(15)
Moderate	37(61.67)	24(40)	33(55)	17(28.33)	18(30)
Low	5(8.33)	1(1.67)	1(1.67)	32(53.33)	21(35)
No	0(0.00)	0(0.00)	0(0.00)	3(5)	12(20)

Note: Figures in parentheses indicate percentage.

The study revealed that lack of knowledge of improved technologies was the major problem of the study area as 40% of the respondents marked lack of improved technologies as the cause of most of the problems in the production of the mandarin. Shrestha et al., (1998) found that the lack of technical know-how was the main constraint for trying the technology followed by low production and low economic status for cellar store in mandarin orange fruit. Insect pest infestation caused a moderate and lower productivity caused a lower problem in the production of mandarin.

Table 9 – Production problems of mandarin in the study area

Production problems	Lack of insurance	Lack of production materials	Lack of subsidy	Lower productivity	Lack of knowledge of improved production technique	Insect pest Infestation
High	4(6.67)	27(45)	10(16.67)	6(10)	24(40)	18(30)
Moderate	11(18.33)	28(46.67)	26(43.33)	17(28.34)	29(48.33)	36(60)
Low	10(16.67)	3(5.00)	24(40)	29(48.33)	6(10)	6(10)
No	35(58.33)	2(3.33)	0(0.00)	8(13.33)	1(1.67)	0(0.00)

Note: Figures in parentheses indicate percentage.

The study revealed that lower price was the major problem of the respondents during the marketing of the produced commodity (Gautam et al., 2020). Out of 60 respondents, 33 respondents marked lack of knowledge about post-harvest to be a moderate problem in post-harvest and marketing of the produced commodity. Post-harvest insect infestation was a lower problem in the study area.

Table 10 – Post-production and marketing problems of mandarin in study area

Post-production and marketing problems	Lack of knowledge about post-harvest	Lack of information about price and demand	Lower price	Greater loss in transportation	Greater loss during grading and packaging	Post-harvest insect infestation
High	18(30)	26(43.33)	34(56.67)	4(6.67)	11(18.33)	2(3.33)
Moderate	33(55)	18(30)	21(35)	16(26.67)	16(26.67)	18(30)
Low	8(13.33)	15(25)	5(8.33)	36(60)	29(48.33)	32(53.33)
No	1(1.67)	1(1.67)	0(0.00)	4(6.67)	4(6.67)	8(13.33)

Note: Figures in parentheses indicate percentage.

CONCLUSION

GAP is a new concept for Nepalese farmers, and most farmers are unaware of it. Factors like: contact with extension agents and participation in training related to GAP significantly affect the awareness of farmers on GAP. In other words, lack of proper extension services, lack of training on GAP, and low participation of farmers in training are the challenges for awareness of GAP. Adoption of Good Agriculture Practices is critical to agriculture's long-term viability. As a result, the government should take the lead in promoting excellent agricultural practices through research based on various agro-climatic conditions. Every year, farmers face insect infestations and a drop in productivity. As a result, more research is needed to generate disease and insect-resistant cultivars with increased yield potential.

Further, GAP modules are mostly generic and not commodity particular, hence focus should be turned to developing commodity-specific GAP modules, such as mandarin GAP, in this case, to provide a foundation for farmers to build on. Farmers who adhere to GAP principles should be provided with special allowances and incentives, and a public awareness campaign should be launched to educate both farmers and customers about the benefits of following GAP and eating food grown on GAP-certified farms.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this paper.

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