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Consumers' Willingness to Pay Premium for Pesticide-Free Peach Fruit in District Swat, Khyber Pakhtunkhwa

Zia ur Rehman[1], Amjad Ali[2,] Abbas Ullah Jan[3]

[1] Secondary School Teacher (SST), Government High School Manyar, District Swat Khyber Pakhtunkhwa Elementary and Secondary Education Department
[2]Assistant Professor, Department of Agricultural & Applied Economics, Faculty of Rural Social Sciences, The University of Agriculture, Peshawar
[3] Professor, Department of Agricultural & Applied Economics, Faculty of Rural Social Sciences, The University of Agriculture, Peshawar
Corresponding Author: Dr. Amjad Ali. Email: amjad_ali@aup.edu.pk

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Abstract

The study was conducted in District Swat, Khyber Pakhtunkhwa with main aim of finding consumers' willingness to pay premium and identifying the factors influencing their willingness to pay for pesticides-free peach fruit. Cross-sectional data during 2024 was collected by Contingent Valuation Method (CVM) from 199 (139 males and 60 female) respondents in three villages namely: Gogdara, Odigram and Tindodag being the major peach producing area of district swat. The interview schedule incorporated socio – demographic characteristics (age, household size, education, monthly income, gender), Knowledge about pesticides (awareness and health concern) and attitude toward pesticides residues (environmental concern). Descriptive statistics indicated that average age was 33.59 years, average education was 10.02 years and average family size was 5.29 members. Moreover, 57% of respondents were aware of pesticide use in fruits, 56% respondents were health conscious and 54% respondents were found concerned about environment. Binomial logistic regression model revealed that education, income, health consciences and environmental concern are positively significant factors in increasing willingness to pay for pesticides free peach fruit . Model further showed that age has negative effect on willingness to pay and gender and family size were statistically insignificant. Based on findings study recommends: informal awareness sessions for aged people regarding pesticides hazards, strengthening of formal education and focus on livelihood opportunities in order to increase consumers' willingness to pay premium for organic agricultural products in study area.

Key words: Pesticides, Peach fruit, Willingness to pay, Contingent Valuation method, Binomial logistic model, Khyber Pakhtunkwa district swat.

Introdution

Increase in the world population is the major cause of the increased demand in food production. Meanwhile, pesticides use in agriculture has significantly contributed in control of pests and increase

in crop yields to ensure enough food for the world's population (Tudi, M et al., 2021). However, pesticides adverse effect on environment, ecosystems and humans have been pointed in literature (Kim et al., 2017, Damalas and Eleftherohorinos, 2011). Exposure to agricultural use of pesticides can cause acute and chronic health effects, depending on doses type and route of entry including cancers, diabetes, asthma, kidney and neurological diseases. In general population and consumers, ingestion is main route of exposure, by taking food and drinking water contaminated with pesticides residues (De Graaf et al., 2022).

Pakistan is an agrarian country and 66% of its population is directly or indirectly involved in agriculture. Agriculture contributes 19% to total GDP of Pakistan and generate revenue through exports. During Green Revolution in order to increase productivity pesticides were introduced ,however its history is traced back to 1954 when for the first-time pesticides were used in Pakistan. Initially free of cost pesticides were given until 1969 and after that its use was subsidized. Available statistics shows that in 1994 pesticides import was 270 tons which grew to 69,897 tons in 2008 (Hafeez et al,. 2008 : Jabbar et al,. 1994).

In Khyber Pakhtunkhwa 70% of pesticides are used in fruits and vegetables. According to World Bank studies on average 47mg to 187mg of residuals of pesticides are found in peach fruit in study area. Compare to other fruits pesticides usage on peaches is more about 7 to 10 times (World Bank, 2016). Pesticides along with health issues, contaminate water and reduce population of useful (honey bees) insects. For sustainable growth usage of pesticides need to be rationalized (Bayo and Goka, 2016).

Pakistan produce variety of fruits and are exported to different countries of the globe. Pakistan is famous for quality peach fruit mostly produced in Khyber Pakhtunkhwa(KP). Statistics illustrate that almost 0.045 million hectares land produce 0.45 million tons in fruits KP. While, area under peach fruit is 0.0071 million hectares with production of 0.0175 million tons. During 2024 peach production in district swat was 45,533 tons followed by, Mardan (3617), Buner (1018), Dir (1066), Haripur (472), Peshawar (930), Nowshera (790) and Charsadda (570) respectively (GOP, 2024). District Swat share 37% in peach production of Khyber Pakhtunkhwa.

Concern over food safety, environmental sustainability, and human health has significantly influenced consumer preferences toward pesticide-free food products worldwide. Fruits, particularly fresh produce like peaches, are often exposed to high levels of pesticide application, that raise serious concerns regarding chemical residues and the associated health risks. Consequently, consumers are becoming more conscious of the quality and safety of the food they purchase, thus increase the demand for pesticide-free fruits. Recent literature highlights that pesticide-free food products are perceived safer alternatives compared to conventionally produced food. Studies have shown that consumers are increasingly willing to pay a premium price for such products due to their health benefits and reduced exposure to harmful chemicals (Hu et al., 2024). Moreover, consumer awareness regarding pesticide residues has been identified as a key factor influencing purchasing decisions and willingness to pay (WTP) for pesticide-free products. Several studies from developing countries supports this trend. Study conducted in Nepal revealed that consumer awareness about pesticide residues and its associated health risks significantly increases their willingness to pay for pesticide-free fruits and vegetables (Ghimire & Khadka, 2023). Similarly, research conducted in India found that income, education and awareness levels are major determinants in influencing consumers' WTP for pesticide-free produce (Koulath et al., 2023).

In the context of Pakistan, existing studies indicate a strong consumer inclination toward pesticide-free fruits. Khan et al., (2018) found that 93.5% of respondents were willing to pay higher prices for pesticide-free fruits, with a substantial proportion willing to pay premiums ranging between 6% and 20% above conventional prices. These findings necessitated the need for such studies to properly explore market potential for pesticide-free fruits within the country.

Despite this growing interest and need, there is limited empirical research focusing specifically on consumer willingness to pay for pesticide-free fruits at the regional level, particularly in District Swat, which is one of the major peach-producing areas of Pakistan. Swat being renowned for its high-quality peaches, yet concerns regarding pesticide use and food safety remain largely unexplored from a consumer perspective. Furthermore, studies on fruits such as apples indicate that consumers are willing to pay a premium for attributes like reduced pesticide use, traceability and environmentally friendly production practices. These factors emphasize the importance of food safety attributes in shaping consumer demand.

The findings would contribute to the existing body of knowledge and provide valuable insights for policymakers, farmers and marketers to develop strategies that enhance the production and marketing of pesticide-free peaches in District Swat. Specifically, the study would assess, willingness to pay a premium and the associated socio-economic factors influencing the consumers' WTP for pesticide-free peaches in study area. The study would suggest recommendations based on findings for targeted interventions in study area.

Review of literature

Pesticides are group of chemicals used to destroy and control various pest population. Several studies revealed direct relationship between pesticides application and incidence of food poisoning, diseases and allergies. It kill soil microorganism, disrupt the natural ecosystem of the farm and leave residues on food product (Hayati et al., 2017). Despite its harmful effects, pesticides free fruits and vegetables are not produced comprehensively, rather their production is still at a preliminary stage. Marketing of such products needs to examine consumers' attitude and factors affecting their decision regarding price premium compare to conventional ones. Across the countries' researchers have investigated consumer's' Willingness To Pay (WTP) for pesticides free fruits and vegetable by employing various elicitation techniques. Although, a survey based-economic technique " contingent valuation method (CVM) have been applied in most of these studies (Khan et al., 2018, Gowdru and Dias, 2017 and Hayati et al., 2017). CVM technique estimate WTP directly by probing consumer to indicate his/her willingness without purchasing the hypothetical product. Appropriate elicitation method and survey to get accurate data are most important parts while applying CVM. Khan and Jan (2018) conducted study on factors influencing households' WTP for pesticides free fresh apple fruit in district swat. They reported that household's age, education and income have positive effect on consumer's WTP, while household family size was noted negatively correlated with WTP for pesticides free apple fruit in study area. Bhattarai (2019) investigated consumers' WTP for organic vegetable in Kathmandu valley, Nepal. To elicit consumer's WTP, single bounded dichotomies choice contingent valuation method was employed. Respondent education, income and presence of chemical residues were found significantly and positively related to consumer's WTP for organic vegetable. Nandi et al., (2016) used contingent valuation method to analyze consumer WTP for organic fruits and vegetable in India. Logit model was used to identify determinants of WTP. Consumer's perception regarding presence of pesticides residues in conventional fruits and vegetables, monthly household income, availability of organic produce market, household size and gender of respondent were noted significant determinants of WTP. Narine et al., (2015) applied logistic regression to analyze factors influencing consumer's WTP for organic tomato in Trinidad. It was noted that consumers are willing to pay 20 percent premium for organic tomato. Gender, level of education, income and perceived health benefits are factors that influence WTP premium for organic tomato. Coulibaly et al., (2013) employ hedonic pricing model to analyze consumer's WTP for organically grown cabbage and tomato in Ghana and Benin. It was found that consumers are willing to pay 57 percent more for cabbage and

50 percent more for organic tomato. Main determinants were level of consumer education, awareness of health risk, income level and pesticides residues.

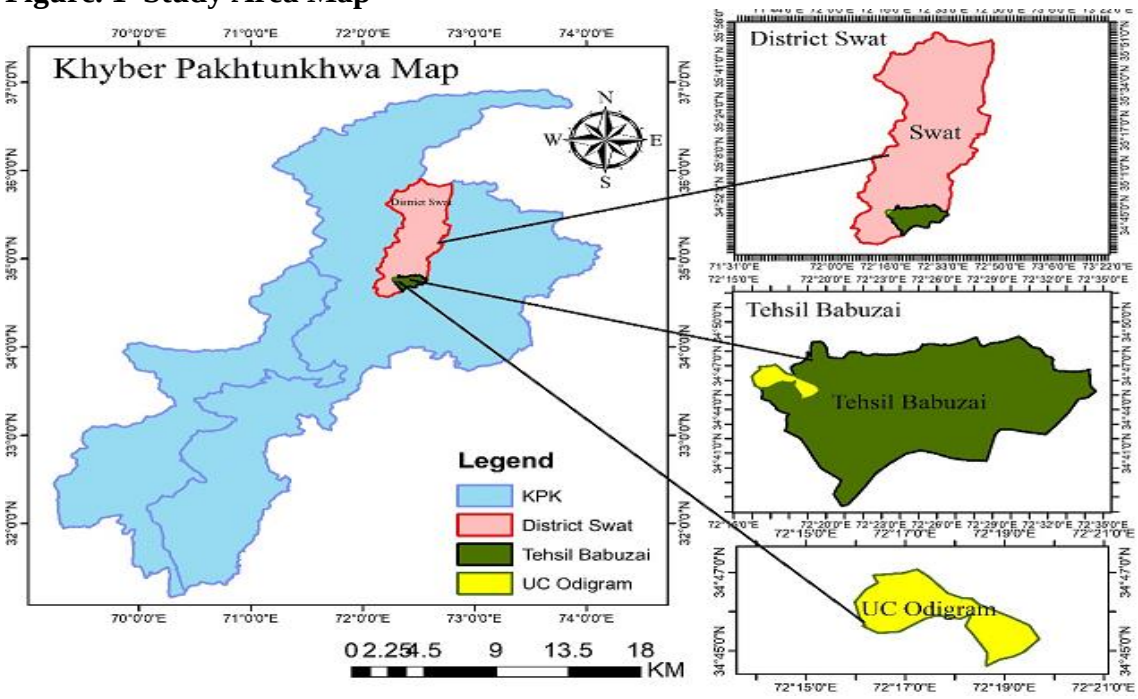
Thus different researchers studies WTP for organic products in different countries. Consumer's elicitation by contingent valuation method for measuring WTP premium price have extensively used by researchers. Literature review suggests that socio-economic and demographic factors like age, income, education and gender influence WTP. Bektas et al., (2011) found that age is positively associated with WTP. Elder's people are willing to pay more for chemical free products. Similarly, higher education increase awareness and health concern and increase WTP for safer pesticides free fruits than conventional. In this connection, Gumberg and Joyti (2017) and Vidogbena et al., (2015) have also reported positive relationship between WTP and respondents education level. Groff et al., (1993) highlighted that gender is also a significant factor influencing WTP for organic products. They reported that female are willing to pay more than male for organic agriculture products. Similarly, Hai et al., (2013) pointed that income is also an important WTP influencing factor. With increase in income consumers' willing to pay higher premium for pesticides free fruits and vegetables. Review of relevant literature could contribute in achieving study objectives successfully and unearthed valuable understandings closely related to the main topic.

Methodology

Universe of the study

Current research was conducted in District Swat. It is known for producing many tasty varieties of peach. In district swat peach production is dominant because of its high economic returns and related agro-based business. Peach production is a source of employment in study area (Mamoon et al., 2015). Total area of district is 5337km square and population of district is about 2.3millions, urban population is 17% and rural population of district swat is 83%. Average family size is 8.8 per family. It consists of 7 tehsils and 65 union councils. Swat lies in temperate zone. Its weather is suited for fruits production peach and apple is produced in swat and is exported to whole country. Figure. 1 illustrate the district, randomly selected tehsil (Babozai) and union council (Odigram).

Figure. 1 Study Area Map



Sampling Technique and sample size

Current study based on survey carried out in main peach growing area of district swat. Multistage random sampling technique was applied in current study. In first stage, district Swat being the major peach producing district, was selected. In second stage, Thehsil Babuzai was selected. In third stage, union council (UC) Odigram was selected. In fourth stage, villages Gogdara, Odigram and Tindodag were selected for sample respondents. These villages are purely rural in nature. In fifth stage Yamane's (1967) formula was applied for sample respondents as follow:-

$$n = \frac{N}{1+Ne^2}$$

Where;

n = respondents selected for interview out of total (sample size)

N = represent total household in study area = 397

e = precision level = 0.05

n = $397/1+397(0.05)^2$ = 199

Respondents from each village council were selected through proportional sampling allocation technique developed by Cochran (1977) was applied as follow:-

$$n_s = \frac{Ni * n}{N}$$

Symbols represent:

n = number of respondents interviewed in selected village councils

N_i = number of total respondents in selected village councils

n_s = sample size for the study

N = total number of respondents in the study area.

List of respondents was obtained from union council office.

Table .1 **Sample Respondents Proportional Allocation in Study Area**

District	Union Council	Villages	Population	Sample size
Swat	Odigram	Gogdara	141	70
		Odigram	157	79
		Tindodag	99	50
Total			**397**	199

Source: Source: Local Government concerned UC District Swat, 2024

Contingent Valuation (CV) Survey

In Pakistan, it is hard to differentiate pesticide-free fruits from pesticide containing fruits because there is no market where they are labelled differently. To find value of products which doesn't have any market or whose value is onerous to find via market, non-market valuation methods are used such as hedonic pricing method, travel cost method and contingent valuation method. Contingent valuation method is most prominent, as it directly asks consumer about his willingness to pay or accept about a good or service. It is called contingent valuation method as it put a hypothetical picture in front of respondent and he answers hypothetically. Contingent valuation survey was held in district swat and data from 199 consumers through structured questionnaire by random sampling technique. Data was collected on consumer willingness to pay and some other factors such as attitude of consumer toward pesticides free fruit. Structured questionnaire consists of several parts, first one contained personnel information about the respondent such as his or her age, education, income etc. Second section was concerned with respondent willingness to pay for pesticides free fruit and he or she chose between willing to pay or not. Third section consist question about respondent knowledge

of pesticides free fruit and its impact on environment and human health.

Model Specification and Estimation

In econometric the dependent variables can be measured by four different scale, e.g ratio scale, interval scale, ordinal scale and nominal scale. In current study, because of the nature of dependent variable: willing to pay and not willing to for pesticides free peach fruit in study area, literature preferred binary logit model. In binary logit model dependent variable, carry the values one and zero, illustrated as follow:-

Pi (Yi=1: willing to pay premium price for pesticides free peach fruit

Pi (Yi=0: Not willing to pay premium price for pesticides free peach fruit

For Yi=1

$Pi=\frac{1}{1+e^{-zi}}$ where $Zi = \beta X+\mu i$

For Yi =0

$1-Pi=\frac{1}{1+e^{zi}}$

Taking ratio of 1 and 2

$$\frac{Pi}{1-Pi}=\frac{1+e^{zi}}{1+e^{-zi}}=e^{zi}$$

Where,

$\frac{Pi}{1-Pi}$ is simply odd ratio in favour that a respondent is willing to pay premium

Now taking log of odd ratio.

$Ln\ (\frac{Pi}{1-Pi}) = Zi = \beta Xi + \mu i$

$Zi= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7$

Where,

X_1 = Age of respondent in years

X_2 = Formal education (years)

X_3 = Gender

X_4 = Family size of respondent (No.)

X_5 = Income category

X_6 = Awareness level of respondents

X_7 = Health consciousness of respondent

Description of selected variables are given in table 2.

Table.2 : Description of explanatory variables

Name of variable	Nature	Description
Age (year)	Continuous	Age of the household's head
Education (year)	Continuous	Education of the household's head
Family size (No.)	Continuous	Member in each household
Income (Rs.)	Continuous	Income of the respondent
Gender	Dummy	1= male, 0 = female
Awareness	Categorical	Awareness regarding pesticides hazards
Health Concern	Categorical	Attitude toward health
Environment concern	Categorical	Respondents attitude toward environment in context of pesticides use

Results and Discussion

Primary data on socio-economic characteristics (age, education, family size, and extension contacts) that influence decision-making were identified and the findings are presented in Table 3. Age plays a role in learning, attitude and Behaviour of consumers. It is expected to have both positive and negative impact on WTP. Older consumers' tend to have more risk-averse, traditional, and conservative to adopting new purchasing pattern. On the other hand, younger are more risk takers, open to exploring new avenues and willing to pay premium for organic products. The results show that the average age was 33.59 up to maximum of 55 years. Education plays an important role in decision making, resource optimization and the adoption of modern technology In some studies, it is used as a proxy for managerial ability, which sharpens capabilities to utilize information effectively. Table 3 shows that, on average, respondents were literate up to the matric. The findings also reveal that the highest level of education attained in the study area was 18 years. Family size refers to the total number of individuals living in the same household, whether related by blood, marriage, or adoption. It is assumed that larger family provides an advantage of offering labor resources during peak activities seasons in rural areas. Large family size can also strain financial resources and lead to inefficiencies due to hidden unemployment. The majority of families have an average of 5.29 members. Average income was reported Rs.52,257.70/- up to maximum of Rs.150,500/-. Similarly, dummy variables shows that 57% were aware of pesticides hazards, 56% were health conscious while 54% shows their concerned regarding environmental deterioration from pesticides use.

Table. 3: Socio-economic Characteristics of respondents in study area

Variable	Mean	Minimum	Maximum
Age	33.59	22	55
Household size	5.29	2	12
Education	10.02	0	18
Income (Rs. Monthly)	52,257.70	100,000/-	150,500/-
Gender	0.63	0	1
Awareness	0.57	0	1
Health Concern	0.56	0	1
Environment concern	0.54	0	1

Source: Authors' calculation from sample data, 2024

Discussion

Results of binomial logistic regression model based on 199 observations are presented in table 4. The likelihood ratio chi-square value and the associated probability value (LR chi2 = 117.24, $p < 0.001$) suggest that the model as a whole is significant and having a good fit. The pseudo R-squared value of 0.4464 indicates a moderate explanatory power of the model due to cross sectional nature of the study. Age has a negative and statistically significant coefficient ($\beta = -0.0375$, $p = 0.039$), indicating that with an increase in age, the likelihood to pay for pesticides free peach fruit decreases. Possible reasons might be the perception of older consumers that local fruits are safe. Furthermore, less exposure to social media and health campaign compare to younger consumers, fixed income, traditional buying pattern and distrust on labelling decrease willingness to pay for pesticides free fruits in older individuals. Willer H and Lernoud (2019) and Loureiro et al., (2001) reported that younger consumers are willing to pay more for organic products. While Gracia and Magistris (2007) and Krystallis and Chryssohoidis (2005) pointed that older consumers are less responsive to organic products and labelling. Education shows a positive and significant effect ($\beta = 0.5314$, $p = 0.027$), implying that more educated respondents are more likely to have a higher probability of willingness

to pay for organic fruit in study area. This aligns with the general understanding that education increases awareness and informed decisions. Family size is statistically insignificant ($p = 0.872$), indicating that it does not play a meaningful role in influencing consumer WTP for organic fruits. The result is not align with Massaglia et al., 2019, which suggested that presence of children in family influence consumer behaviour to pay for organic fruits and vegetables. They also highlighted that rural consumers are more frequently exposed to pesticides and consequently may have more aware of the adverse effects of pesticides exposure on their family. The results of this study demonstrate that income has a positive and highly significant coefficient ($\beta = 0.0300$, $p < 0.001$), suggesting that higher-income individuals are more likely to afford and prefer pesticides free fruits. Awareness regarding pesticides has a strong positive and significant impact ($\beta = 1.3810$, $p = 0.0006$), indicating that individuals with greater awareness are significantly more likely to choose pesticides free peach fruit. This means that awareness is a key factor to effect attitude and behaviour of consumers. Similar results was also reported by Liu, L et al., (2016). Health concern is also positive and statistically significant ($\beta = 0.7235$, $p = 0.047$), suggesting that individuals who are more concerned about health are likely to prefer pesticide-free products. These results agreed with the study conducted by Mihalache et al., (2021). Khan et al., (2018) also found that the health concerned consumers are more likely to pay higher premium for WTP than those not concerned. They conducted their study in Pakistan. Gender is statistically insignificant ($p = 0.1895$), implying that there is no meaningful difference between male and female respondents in influencing WTP for organic fruits in study area. Environmental concern is also insignificant ($p = 0.482$), suggesting that environmental awareness alone does not strongly influence the decision in this context, however, results not align with Khan et al., (2018). The sample of this study cover a major peach growing district, however, some limitations need to be considered. Firstly, the study was confined to one district. Secondly, considering non-peach consumers as a control group might improve the efficiency of the existing results, therefore it need further investigation. Thirdly, the interview schedule was created according to the theoretical framework and previous studies and its reliability was assessed before data collection, however, the test-retest was not carried out that ensured the measurements are both representative and consistent across time. Finally, self-reported behaviour was employed, factors such as cognitive bias, egocentrism and other empowering factors may impact the data reporting. Researchers like Zhang et al., (2022) and Da Cunha et al.,(2019) have preferred the observed behaviour approach to ensure actual response and further investigation.

Table. 4: Binomial Logistic Regression Estimates

Variables	Co. efficient.	Std. Deviation	T-Value	P-Value
Age (years)	-.0375	.0197	-2.96	0.039
Education (years)	.5314	.2409	2.21	0.027
Family size (No.)	-.0118	.0732	-.16	0.872
Income	.0300	.2605	3.95	0.0000
Awareness regarding pesticides	1.3810	.4986	2.77	0.0006
Health concern	.7235	.3645	1.98	0.047
Gender(dummy)	.0652	.4926	.13	.1895
Environment concern	0.38	0.558	0.57	0.482
Constant	-2.0766	1.002	-2.07	0.038

Number of obs = 199 LR $chi^2(8)$ = 117.24 Prob > chi^2 = 0.0000
Log likelihood = -72.705451 Pseudo R^2 = 0.4464

Source:- Authors' estimates from survey data, 2024

Conclusion and Recommendations

Agricultural use of pesticides has gained the power of providing food to majority of the world population but at the cost of damaging human health and the environment. Alternative food production such as organic and pesticide free farming has been emerged to protect environment human, plants and animals from the use of potential hazardous chemicals. Literature has pointed that fruits produced without the use of pesticides are generally higher in prices than those produced under conventional methods. Consumer behaviour and WTP for pesticide free food determines the market potential for organic production, therefore current study was designed to analyse consumer WTP for pesticides free peach fruit in district Swat by using contingent valuation method (CVM). Descriptive analysis showed that average age was 33.59 years and average household size was 5.29 members per households. They were found literate up to matric with average monthly income of Rs. 52,257.70/-. More than 50% respondents were found concerned about their health and environment. 57% reported their awareness about pesticides and associated risks,. The factors such as education, income and household's awareness regarding pesticides were found significantly important in shaping WTP for pesticides free peach fruit in study area, while age was found significantly negative. Understanding the factors influencing consumer WTP might help to develop suitable targeted intervention strategies for education, livelihood strategies to increase income, awareness-raising campaigns and health effects from pesticides exposure.

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