

Study on the Contribution of Bee Farming On the Socio-Economic Transformation of Communities in Rural Areas in Arua District Pajulu Sub-County

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Abstract .In order to assess the impact of beekeeping intervention on the socio-economic transformation of rural communities, figure out the factors that incentivize smallholder farmers to participate in beekeeping, and determine the differences in household incomes between participants and non-participants, this paper accumulated the beekeeping practice, marketing system, existence of opportunities, and constraints in Uganda. Due to its abundant apicultural resources, Uganda is the country's top producer of honey and beeswax. Traditional backyard, traditional forest, transitional, and enhanced beekeeping techniques were all available in Uganda. The chi-square test revealed a significant relationship between beekeeping and socioeconomic transition since the p-value (0.04) was smaller than the crucial value at the 95% confidence level, supporting the null hypothesis. The opportunities for beekeeping in Uganda have been found to be the presence of natural forests with sufficient apiculture flora and water resources, the existence of numerous bee colonies, the accessibility of farmers with indigenous knowledge, the socioeconomic value of honey, and the demand for honeybee products. Although $0.026 > 0.05$, we accept the null hypothesis and get to the conclusion that the disturbance terms are normally distributed with a bell-shaped curve by comparing the jarque-bera with the significance level. Despite the fact that the price of honey and beeswax for export was rising, the domestic market's honey price was generally higher than the international price, making Uganda's honey export less profitable due to the nation's rising demand. As a result, many of these honey exporters declined to participate in the global honey trade. Traditional hives are less productive than transitional hives, which also don't demand as many high-end beekeeping supplies. The only costs involved are providing the design of the hives, training and initial support. In addition, transitional hives significantly improve the quality of honey since it allows farmers to inspect ripening of the honey. Farmers' annual incomes from honey can be improved through increasing the adoption of improved bee hives. The higher income also motivates the beekeepers to adopt the technology more intensively. Therefore, honey processors, governmental and NGOs should intensively promote the adoption of transitional beekeeping to help farmers increase their income with low cost.

Keywords: BEE FARMING AND SOCIO-ECONOMIC TRANSFORMATION

Background of the study

Given the favorable ecological parameters and floral diversity that now exist, Uganda is one of the nations with a significant amount of potential for beekeeping (UEPB 2005; Kilimo Trust 2012). In the country, regions with existing floral resources are ideal for beekeeping (UBOS, 2010). In terms of nectar and pollen grain quality and quantity, forests are an adequate source of food for bees. Because of this, beekeeping may potentially expand prospects for forest preservation (CIFOR 2008). When encouraged among communities near forests, beekeeping offers dependable sources of income (Adgaba, 2014).

Uganda produces only about 5,000 metric tons of honey annually, which is only 1% of the estimated 500,000 tonnes of potential national annual production, despite the favorable ecological conditions and floral diversity (Aber, 2012). The primarily small-scale operations that use conventional manufacturing techniques are to blame for Uganda's low honey production. As a result, the amount of honey produced is insufficient to fulfill the constantly rising domestic and regional demand.

Just 1% of the projected 500,000 tonnes of output potential is harvested by Ugandan beekeepers. Weak policies, underinvestment, and a lack of knowledge sharing among stakeholders are only a few causes of low productivity. The region of northern Uganda, where 60% of households have hives, offers the greatest potential for raising beekeeping production. Beekeepers in the area face challenges due to the seasonality of forage, restricted availability to tools and training, and exacerbated droughts and bushfires. Forage crop development has been shown to boost hive productivity and colony survivability.

The profitability of a beekeeping operation within the farmstead determines its success in rural areas. In order to support colonies during times of forage scarcity, this study estimated potential yield changes for three different hive types together with a dry season carbohydrate supply. It was proposed that providing a permanent bee foraging plant will decrease absconding, boost colony survivability, and result in higher production.

PROBLEM STATEMENT

Given its variety of floral species, Uganda has a very high potential for beekeeping. Due to very traditional production methods and a lack of apicultural research, this potential has not been completely realized. The survey of 60 beekeepers in locations close to the Kalinzu forest served as the basis for this study, which was carried out in May 2014. A logistic regression model was used in the study to examine the variables influencing the adoption of enhanced beehives. Where $\ln Y_i = 0 + 1 (\log K) + 2 (\log L) + 3 (\log Q) + E_t$ (logistic model). The study also examined the regional honey value chain to identify particular difficulties faced by beekeeping in the research region. The adoption of improved beehives was shown to be largely influenced by education and training in beekeeping. Beekeepers, middlemen, and industrial processors dominated the honey value chain. The major issues affecting honey producers were pests, a lack of equipment, low prices for bee products, and farm sprays. Due of high transportation expenses, low honey gathering rates, and non-cash payments from customers, middlemen were restricted.

Just 1% of the projected 500,000 tons of output potential is harvested by Ugandan beekeepers. Low output is ascribed to a number of issues, including inefficient policies, inadequate investment, and a lack of knowledge sharing among players (Haftom, 2013). The region of northern Uganda, where 60% of families have hives, has the most potential for increasing beekeeping productivity. Beekeepers in the region are constrained by forage seasonality, limited access to equipment, and training, accentuated by extended droughts and bush fires. The benefits of planting forage crops to increase hive yields and colony survival are known.

Specific objectives of the study

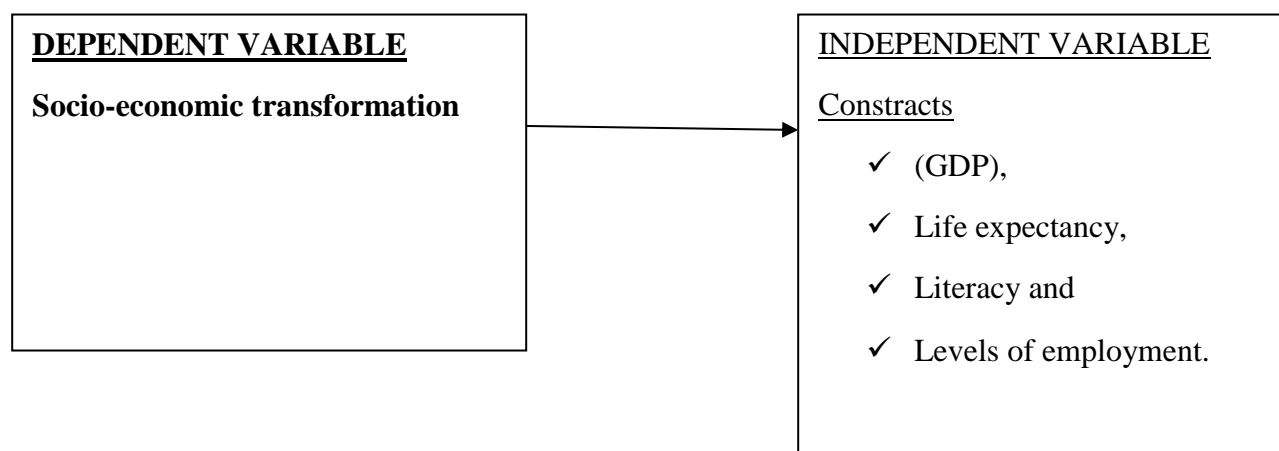
The objectives that guided the study included the following;

1. To assess the impact of beekeeping intervention on the socio-economic transformation of communities in rural areas
2. To determine factors that influence small holder farmers to participate in beekeeping.
3. To assess the differences in household incomes between participants and non-participants.

Research Questions

1. What is the impact of bee keeping intervention on the socio economic transformation of communities in rural area of Pajulu sub-county Arua district?
2. What are the factors that influence small house farmers to participate in bee keeping in Pajulu sub county arua district?
3. What are the differences in house hold incomes between the participants and non-participants in Pajulu sub count arua district?

Conceptual framework



Source: adopted from Mujuni et al. (2012) and modified by the researcher

METHODOLOGY

Research Design

The study's exclusive data on happenings came from the use of both qualitative and quantitative methodologies. The study was carried out utilizing a descriptive survey. In studies where the goal was to describe the characteristics of a certain group, estimate the proportion of persons who possess particular qualities, and make predictions, surveys were described without manipulation.

To test a hypothesis or reveal the present situation of the study subject in relation to individual perception, attitude, and behavior, a descriptive survey was utilized to collect data. These descriptive surveys were suited for gathering information for educational purposes and provided a wealth of data for our investigation. Data that describes events and organizes, tabulates, illustrates, and summarizes the data collection are collected for descriptive research. Graphs and other visual aids are frequently used.

Study population

The term "target population" refers to any member who is a part of a real or imaginary group of individuals, an occasion, or an item for which the researcher is hoping to produce study results. A population is a large collection of people, things, circumstances, or things with observable qualities. It is the total of anything that complies with a particular specification. In the Arua district, study data were gathered from 5 rural homes. This study focused mostly on farmers and the neighborhood leaders, including men and women. A random sample of 126 respondents was gathered, and they were first divided into tiny cohorts known as strata before being combined to form a stratum.

Sample size

The researcher selected (126) respondents out of which (45) male children, (16) female children, (60) elders male and (60) elders females who had knowledge on beekeeping.

Table 1 the number of respondents per category

Item	Population	Sample
Boys	40	45
Girls	20	16
male elders	60	15
Female elders	60	50
Total	185	126

Sampling techniques

The researcher used simple random sampling which means each individual in the total population had an equal chance of being selected for the study. This was particularly used to select the participants. The researcher also used purposive sampling for selecting elders who helped so much in selecting respondents who had much knowledge on the problem investigated and convenience sampling was also used to select respondents to help the researcher to choose the closest researcher he came across. In short, the researcher used both probability sampling and non-probability sampling techniques.

Data collection methods and instruments

The data was collected from both primary and secondary sources. Secondary information was obtained from the available literature. Questionnaire and interview guide used as well.

Questionnaire survey

The researcher used structured questionnaire method to collect both qualitative and quantitative data from the respondents identified to be knowledgeable about the study. Open ended questions were designed to allow the respondents to fully express their views. These tools were advantageous because respondents had to fill in the questionnaires and freely give information without fear.

Interviews

Interview schedules were organized basically for the key informants who had prior knowledge and expertise on the study. The interview method was used because of the nature of its flexibility and it enabled the researcher to change the questions depending on the response of the respondents.

Data quality control

In order to ensure reliability and validity of data collection, the research was conducted under the guidance of an academic supervisor as well as using the Durbin Watson test. Proper sampling using convenience, purposive sampling was used. Tools that were used were being pretested and triangulation of data as a method was adopted as well.

Data Analysis

After data had been collected, it was sorted, edited and analyzed in tables, using descriptions in percentages and frequencies, unit root tests, correlation coefficients as well as regression analysis to portray the various objectives that was used in the study. Both helped in obtaining findings and drawing conclusions thematically.

RESULTS

Gender of respondents.

The researcher investigated the respondent gender. The reason was found out if both sexes hold same views or different ones on the topic of research and various objectives of the research.

This is prepared officially below,

Table 1 Gender of respondents.

Gender	Frequency	Percentage
Male	45	45.0
Female	55	55.0
Total	100	100%

Source primary data 2022

Table 4.1, Shows that female respondents constituted 55 (55%) while male respondents were 45 (45%).

This implied that females were the major respondents of the study.

Age Brackets of respondents**Table 2 age of respondents**

	N statistic	Min	Max	mean	Std	Skewness		Kurtosis	
Age	126					statistic	Std Error	statistic	Std error
Valid N	126	22	56	34	11.786	0.456	0.345	0.487	0.475

Source: primary Data 2022

The table represents that the minimum age was 22 and the maximum age was 56 as well as the standard deviation of 11.786. Since the standard deviation lies within the range of the minimum and maximum age, the given data is reliable and hence gives a good fit where R-squared value must be greater than adjusted R-squared. This implies that most of the respondents were between 20-30 years and the least number of respondents were between 41-50 years.

However since the Jarque-Bera value 0.487 is greater than the critical value (0.05) at 95% confidence interval, we reject the null hypothesis and conclude that the disturbance terms are not normally distributed. Academic background of respondents

Table 3 academic background of the respondents

Academic background	Frequency	Percentage
Certificate	26	26.0
Diploma	45	45.0
Degree	24	24.0
Others	5	5.0
Total	100	100%

Source: primary data 2022

The above table shows level of Education of respondents and it reveals that 26 of the respondents had attained certificate of Education 5 (5%) of the respondents had attained other level of Education while 45 (45%) of the respondents had attained diploma level of Education and 24 (24%) of respondents had attained Degree. This implies that the highest percentage of respondents were diploma holders followed by the respondents having certificate level of Education and the degree holders followed. The least number of respondents fall under other various levels of Education.

Departments of the respondents

Table 4 departments of respondents.

Department	Frequency	Percentage
Stores	9	9.0
Top management	5	5.0
Accounts	6	6.0
Purchasing	34	34.0
Others	46	46.0
Total	100	100%

Source: primary Data 2022

From the table 46.0% of the respondents were from the department , 34.0% are from the purchasing sector, 6.0% are from Accounts department, stores management are 9.0% and 5.0% are from the top management . From the study findings in the table, it's clear that the highest number of respondents came from other various departments and these were followed by the purchasing sector respondents while the least number of respondents came from the top management. Establish the effect of bee keeping on the household income of the people Pajulu sub-county Arua district

Table 5 Establish the effect of bee keeping on the household income of the people Pajulu sub-county Arua district

Respondents	SA		A		NS		D		SD		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
There are Increased incomes levels among the people of Pajulu sub-county Arua district.	33	33.0	53	53.0	10	10.0	2	2.0	0	0.0	100	100
Increased food security for farmers Pajulu sub-county Arua district.	56	56.0	40	40.0	2	2.0	0	0.0	2	2.0	100	100
Increases agricultural productivity	46	46.0	34	34.0	6	6.0	9	9.0	5	5.0	100	100
Bee keeping reduces farmers' vulnerability to	28	28.0	56	56.0	5	5.0	9	9.0	2	2.0	100	100

climate variability which increases crop yields													
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Source: primary data 2022

According to the table, 35% of the respondents strongly agreed respectively that there are increased incomes levels among the people of Pajulu sub-county Arua district. Accordingly, 10% were not sure, 2% disagreed to the idea. From the findings, Livelihood of communities living in mountain areas is typically dependent on subsistence agriculture and smallholder farming. Rural mountain communities generally require an additional source of income, especially cash income, to meet their routine livelihood requirements. Findings of the study suggest that beekeeping is proven to be such an alternative livelihood option which provides an alternative income security to smallholder farmers living in rural mountain areas of Chitral. Findings of the study illustrate that both beneficiary and non-beneficiary households included in the study were able to use income earned from beekeeping for household benefit 56% of the respondents agreed to the notion of increased food security for farmers of Pajulu sub-county Arua district. Bee keeping practices by farmers, 40% agreed, 22% were not sure, while 2% strongly disagreed to the idea. The impact of beekeeping demonstration on livelihood of the community is assessed based on house hold interview using structured questionnaire before and after beekeeping intervention. This includes household land uses, farm sizes, major crops grown; tree species preferences for charcoal production, the frequency and annual production of charcoal, beekeeping management practices and income from the sale of honey were interviewed.

The table then shows that 46% of the respondents strongly agreed that there is increased agricultural productivity, 34% agreed, 6% were not sure, 9% disagreed while 2% strongly disagreed to the idea. 28% of the respondents strongly agreed that Bee keeping reduces farmers' vulnerability to climate variability which increases crop yields. This was substantiated by a view of one respondent who expressed that, beekeeping contributes to economic security in another way: through the positive effect on pollination in agriculture in the rural areas of developing countries. Even though pesticide use is still on the rise in modern agriculture, managed pollination has been able to make up for certain pollinator deficiencies, and has increased productivity and thus incomes

In a verbal interview, the respondents stated that beekeeping can contribute to securing sustainable livelihoods by transforming vulnerabilities into security. It can be carried out by resource-poor farmers, and is particularly suitable for under-privileged, landless and low-income groups as well as for women, as it requires minimal start up investment and generally yields profits within the first year of operation.

Factors that influence small holder farmers to participate in beekeeping Pajulu sub-county Arua district

Table 6; Factors that influence small holder farmers to participate in beekeeping Pajulu sub-county Arua district

Response	SA		A		NS		D		SD	
	F	%	F	%	F	%	F	%	F	%
Low returns from beekeeping	28	28.0	66	66.0	6	6.0				
availability and improper use of harvesting equipment	30	30.0	41	41.0	4	4.0	20	20.0	5	5.0
Limited and unorganized markets and market channel	38	38.0	56	56.0	6	6.0				
Low quality of honey products	41	41.0	56	56.0	3	3.0				
Shortage of trained personnel	61	61.0	30	30.0	9	9.0				

Low levels of improved technologies	28	28.0	66	66.0	6	6.0				

Source: Primary, Data, 2022

From the table 6, 28% of the respondent say that there is low returns from beekeeping, further from the findings, many farmers have left beekeeping because of low levels of profits and low yields and due to the amount of work and the investments that are required for hives and equipment, Poor apiary husbandry – Especially in the migratory beekeeping system, but also in fixed apiary system, bees are left to look for their own forage and water, and to provide own security from invaders., 66% of the respondents agree and 6% were not sure about this. The study then shows that 30% strongly agree, 41% agree, 4% are not sure, 20% disagree and 5% strongly disagree to the fact that availability and improper use of harvesting equipment. Poor harvesting methods – Rudimentary harvesting methods, for example, using too much smoke or burning the hives, leads to destruction of the bee colonies as well as to contamination of the honey harvest and quality control challenges – Due to limited availability and improper use of harvesting equipment, honey becomes susceptible to contamination and adulteration resulting to low quality honey which cannot enter the formal market chain, but ends up in the informal markets being used as an ingredient for making local brews or herbal products.

From the study, 38% of the respondents confirmed the assertion that u Limited and un-organized markets and market channel, 56% of the respondent agreed, 6% were not sure. The study went ahead to discover that a well-organized market channel is one of the main driving factors for expansion of honey production. Through market channels, producers can be linked to potential buyers. An increased participation of farmers in these channels also leads to more supply for honey processors. In Arua District, there has not been a strong organized market channel for bee products. Limited of standards and grading systems discourage farmers to produce high quality products. As a result, the honey price received varies based on the good will of buyers.

According to the table, 41% of the respondents noted that there is low quality of honey products, 56% of the respondents agreed and 3% were not sure. The study also established that limited adequate production skills and post-harvest handling at all levels often results in poor quality of honey on the market. Excessive use of smoking during harvesting and using inappropriate containers are serious problems in this respect that increase processing cost for processing companies. Since honey producers have limited knowledge of the preferences of their target market, they do not try to make any changes in the quality of their product. The low price also discourages the farmers to add value. Most honey on local markets is un-extracted, unstrained and has post-harvest handling problems it should be noted that 56 (56%) respondents bitterly emphasized the challenges and 41% strongly emphasized the challenges while only 3% disagreed.

According to the table. 61% of the respondents say that Shortage of trained personnel, 30% of the respondents agreed and 9% were not sure.

It was established that the above challenges affect the bee keeping practices as some times reduce greatly on the firm performance on profitability level of the farmers. The verbal findings of the study also indicated that there are still challenges faced by bee keepers, well trained staff plays a significant role in informing actors in the honey channel. There is shortage of skilled personnel for beekeeping management, post-harvest handling, bee product marketing at all levels (federal, regional and district levels) and processing and quality control in the country this increases the knowledge gap of the beekeepers in the rural areas.

From the table, 28% of the respondents noted that there is low levels of improved technologies, 66% of the respondents agree and 6% were not sure with the idea. low levels of improved technologies was reported verbally by the respondents who said that it leads to loss of profits, loss of customers as they migrate to other dealers and loss of customer’s goodwill. The same challenge was reported to lead to delays in delivery of both the products to the market and also the raw materials from the manufacturing of the products.

Table 7 Testing dependence of improper use of harvesting equipment and bee keeping in Arua.

Chi-square	t-computed	t-tabulated
Sigma squared	3.185	0.056

Ho: $\beta=0$

Ha: $\beta \neq 0$

Since t-computed is greater than t-tabulated, we reject the null hypothesis and conclude that availability and improper use of harvesting equipment has a significant effect on bee keeping in Arua district

Table 8. Testing relationship between Beekeeping on the household income of the people Pajulu sub-county Arua district.

The respondents from the study reported of the relationship between the Bee keeping on the household income of the people Pajulu sub-county Arua district can be either negative or positive depending on the way the method/ technique is applied in the Bee keeping practices. The above information as per the study respondents significantly implies that Bee keeping practices can either be negative or positive correlation coefficient and these were further evidenced by the findings as in table 6 below.

Ho: There is no relationship between household incomes on bee keeping in Arua district

Ha: There is a relationship between household incomes on bee keeping in Arua district

Household income	1.000
1.000	0.768
	0.000

Source: Field data, 2022

The correlation coefficient is 0.768 and therefore there is a strong positive correlation coefficient between house hold income and bee keeping in Arua district. This relationship is statistically significant at 5% level of significance since the P-value (0.0000) <0.05 thus the null hypothesis is rejected and conclusion made there is a significant relationship between house hold incomes and bee keeping.

Table 9. Augmented Dickey Fuller test for household income at level and first difference.

variable	Test statistics at Level	5% Critical values	At Level Test statistic	at First Difference	5% Critic Value	At First Difference Probability	at Level Probability At First Difference
Household income	-1.856	-2.345	0.0000	-3.789	-2.895	0.000	0.0001

Ho: Household income rate has no unit root.

Ha: Household income rate has a unit root.

The tau test statistic (-1.856) in absolute terms is less than the 5% critical value (-2.345) in absolute terms thus we accept the null hypothesis and conclude that household income has unit root and conclude that household income is non-stationary at level hence not I (0).

However upon differencing, household income is stationary since the tau test statistic (-3.789) in absolute terms is greater than the critical value at 5% (-2.8945) in absolute terms hence we reject the null hypothesis and conclude that household income is stationary thus integrated of order one.

CONCLUSION

Since agriculture plays an important role in improving household income and livelihoods of the rural population, it is clear that improving the efficiency of agricultural marketing systems is important.

Bee keeping arrangements are one of the options in this regard. This study analyzed the impact of Bee keepings farming on household income originating from organic honey production in the Pajulu sub-county Arua district. Factors which affect household income from honey production were also investigated. In addition, the structure and functioning of Bee keeping farming are examined.

Stratified sampling was used to select survey villages and respondents. Data were collected from Beekeepers that were randomly selected from four villages Propensity score matching was used to estimate the casual effect of Bee keeping farming on household income from honey production. Moreover, Instrumental Variable regression analysis was used to explore the factors that determine household income from honey production.

The first part of the study deals with the function and structure of Bee keeping farming. The nucleus estate model of farming is used in the study area, which includes owning of a production site and collection of honey. The Bee keeping document used for the agreement contains obligations and rights of parties, and stipulations regarding quantity, quality, pricing and enforcement. The price is determined through negotiation based on the market price of honey. Farmers can get from 15 to 20% higher price if they fulfil the quality requirements as described in the agreement.

In order to answer the research questions, the effect of Bee keeping on household income from honey production is investigated. Indeed, the propensity score matching estimation results shows that Beekeeping farming has a positive significant effect on household income.

This result from Microsoft program indicates that participation in Bee keeping organic honey production significantly improves beekeepers incomes in comparison with selling their product at the local market.

Nevertheless, many beekeepers are not aware of the benefits of Bee keeping organic farming.

The second analysis focused on investigating the major problems affecting household income from Bee keeping honey production. Results show that Bee keeping participation contributes to household income from honey production positively. The number of hives or bee colonies owned, which captures the production capacity, is one of the major factors affecting household income from honey production. The number of family members participating in Bee keeping honey production also affects household income. Another factor that significantly affects household income is the moisture content of the honey, which is the main quality parameter of honey production. Since processors are interested in this parameter, beekeepers who produce honey with the required moisture content can earn more income. These results imply the need to increase the distribution of improved bee hives that can help farmers to increase honey production and its quality. In this regard, transitional hives, which can be made from locally available materials, would be a better option. It also implies the need to provide farmers with the knowledge on how to maintain the required moisture content of honey during the production process. On the other hand, household land size owned has no effect on household income from honey production. This suggests that Bee keeping honey production can also be possible even for land less Households or for households who own a small plot of land. . Upon using the chi-square test, it was found that there is a strong dependence between bee farming and socio-economic transformation since the p-value (0.04) was less than the critical value at 95% confidence interval and hence the null hypothesis was accepted. Uganda has been revealed that the opportunities for beekeeping are the availability of natural forest with adequate apiculture flora and water resource, existence of a number of bee colonies, availability of farmers having indigenous knowledge and socio-economic value of honey and demand for honeybee products. However comparing the jarque-bera with the significance level, since $0.026 > 0.05$, we accept the null hypothesis and conclude that the disturbance terms are normally distributed with a bell shaped curve.

Recommendations

To promote and expand the Bee keeping farming approach of organic honey production sustainably the following policy recommendations are given:

Increase the awareness of beekeepers about Bee keeping honey production:

Although participation in Bee keeping farming positively affects household income, it was indicated that farmers' awareness of Bee keeping farming is very low. Organizing experience sharing programs among farmers, preparing field visits for farmers and workshops for concerned governmental officials and NGOs can help to increase the awareness of Bee keeping honey production.

Promote transitional beekeeping methods:

Transitional hives are more productive than traditional hives and do not demand expensive high tech beekeeping accessories. The only costs involved are providing the design of the hives, training and initial support. In addition, transitional hives significantly improve the quality of honey since it allows farmers to inspect ripening of the honey. Farmers' annual incomes from honey can be improved through increasing the adoption of improved bee hives. The higher income also motivates the beekeepers to adopt the technology more intensively. Therefore, honey processors, governmental and NGOs should intensively promote the adoption of transitional beekeeping to help farmers increase their income with low cost.

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