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Article

Evaluation of the effect of farmers' experience on optimization of coffee yields in Chuka Sub-County, Tharaka Nithi County, Kenya

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ABSTRACT

Majority of the farmers in the coffee-growing zones are determined to ensure high production despite the numerous challenges that they face. Though there have been many efforts made by National and County governments with the aim of maximizing coffee production in terms of quality and quantity, farm productivity has remained low and, in some cases, shown a declining trend. The study aimed at assessing the factors affecting farmers' experience in optimizing coffee production in Chuka Sub-County, Kenya. A sample of 153 respondents was selected from a population of 7,428 coffee farmers using proportional stratified random. The respondents were from ten cooperatives in the Chuka Sub-County, and each cooperative was treated as a stratum. The study used Chi-square test to determine association between the effects of farmers' experience and optimization of coffee yield. The logit model was also used to establish the relationship between farmer's experience and coffee yield optimization. The study revealed that coffee farming experience and the number of trainings attended positively and significantly affected yield optimization. On the other hand, the number of journals read negatively and significantly influences yield. Therefore, the study findings recommends that coffee farmers should persist in coffee farming for many years to increase they knowledge and increase training attendance to optimize coffee production.

Keywords: Coffee; farmers experience; optimization of production; yield

1. Introduction

Among the major countries producing coffee, the crop is contributor of great potion of foreign exchange (Schmitt & Perfecto, 2021). Coffee is a source of livelihood for about 80 countries in the tropics, which have a population of more than 125 million people. The total export earnings derived from sale of coffee have shown a positive and significant economic growth and has increased the Gross Domestic Product for most countries producing the commodity (Ogutu *et al*., 2022). The major coffee producers mostly grow *Coffea arabica* L and *C. canephora* Pierre due to their adaptability and high yield. Utrilla-Catalan *et al.* (2022) reported that many farmers across the world are experiencing low and poor quality coffee production which results to rapid loss due to lack of farmers' experience in optimizing coffee production.

Lachenmeier *et al.* (2022) reported that coffee is the second most marketable trade agricultural product after horticultural products accounting for over $17 billion in the crop year 2015/2016 export. Countries in Asia, South America, and Africa have been leading coffee producers worldwide for many years (Wahyudi *et al*., 2020). However, the production of coffee among these countries has been declining due to a lack of farm experience, which is a source of low productivity in terms of quality and quantity of berries produced.

Famer's experience influences the knowledge on factors affecting production, such as changing climate that results in a higher incidence of either increased rainfall or drought

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and increased incidence of pests and disease. Farmers' experience improves production technology adoption, such as improved land management, crop varieties, and agronomic practices (García *et al*., 2020). The major coffee-producing countries in Africa include Cote d'Ivoire, Tanzania, Madagascar, Uganda, Burundi, and Kenya, which export the commodity in raw form, thereby fetching low prices (Maundu & Karugu, 2018). However, research has established that a country like Ethiopia has been at the forefront of encouraging coffee farmers to boost their productivity through local cash crop processing using simple farm equipment (Nyamwamu, 2018). The process facilitates farmers' experience as they are in a position to learn different production processes to increase the quality of their coffee.

In Kenya, coffee production is an essential enterprise that offers a considerable income to farmers and foreign exchange that improves living standards at the farm level. Moreover, coffee production in Kenya has increased GDP, tax generation, and job creation. The increase is attributed to a significant rise in the value of coffee from $ 105.67 million in 2013 to $ 215.97 million in 2017. Most Kenyans have not adopted the consumption of coffee, with only less than 2.5 percent of the commodity being locally consumed despite high productivity. According to Nyamwamu (2018), from 2018, the production has declined, with earnings going to as low as $16.6 million, hence pushing the ranking of coffee yields to the fourth position after commodities such as horticulture, tea, and tourism subsectors which may be affected farmers' experience. Lack of farmers' experience affects the producer's assessment of pests and mitigation of factors such as changes in climatic conditions, which determine the productivity of coffee. Coffee production in Kenya employs about 30 percent of the value chain and contributes to about 10% of the total exports from the agricultural sector (Cheruiyot, 2022). Maundu & Karugu (2018) postulated that Kenya has a high potential for producing quality coffee, despite the country being faced with low yields, which are associated with a lack of promotion for domestic consumption, overproduction in the world during the 1990s crisis, low prices, strict rules prohibiting trade, uprooting of the coffee crop and inaccessible credit facilities. In Kenya, coffee is grown in counties of Kiambu, Nyeri, Kirinyaga, Muranga, Meru, Embu, Machakos, Tharaka-Nithi, Makueni, Nandi, Trans Nzoia, Bungoma, Vihiga, Kakamega, Kisii, Nyamira, and Migori (Ogutu *et al.,* 2022).

In Chuka Sub-County, the coffee farmers face numerous barriers associated with a decrease in area under coffee coverage, low production, and low farmers' income. According to TNCG (2018), the cooperatives located in Chuka Sub-County collected about 88,000 kg of coffee. Out of the 88,000 kg, only 11,000 kg gets to the market, which is facilitated by the poor quality of the cherry. The poor performance of coffee has dire effects on the income and economy of the farmers' area and in the Chuka Sub-County. Nevertheless, the coffee farmers in Chuka Sub-County have indicated that the production of the commodity remains one of the crucial agricultural subsectors in the provision of income for the farmers. Different key players in the coffee subsector have come up with various measures to improve production and quality through general production practices.

However, general production at the farm level continues to decline, with most coffee farmers abandoning farming the crop. The farmers who have abandoned coffee production have turned to other sectors such as dairy farming, construction and building, and tea production. Whether a farmer's experience enhances optimization or non-optimization of coffee yield remains unclear in studies. Deserting the coffee sector through abandoning and uprooting the crop in Chuka sub-County will severely affect the livelihood and economy of farmers in the area. Kawada (2020), MacNairn (2018), and Nghiem *et al*. (2020) have done research on factors influencing the cost of production and marketing affecting the optimization of coffee production, but there exists limited information on the manner farmers' experience affecting the optimization of coffee yields. This article investigated factors contributing to farmers' experiences that affect coffee yield. Furthermore, the study focused on how the number of years of farming, training, and journals read about coffee optimization as the factors influencing farmers' experience.

2. Materials and Methods

2.1. Study area

Chuka Sub-County is located in Tharaka Nithi County, Kenya. The study was done in three wards, namely, Karingani, Mugwe, and Magumoni, in the Sub-County in a total area of 308 km^2. TNCG (2018) stated that the area comprises multiple topographical factors that interact with each other giving the Sub-County an average climate condition. The topographic factors include latitude, prevailing winds, altitude, and vegetable cover. The area's annual rainfall in Chuka Sub-County ranges between 1200 mm-2200 mm, and the annual temperature was between 14 ^{0}C-30 ^{0}C. The annual rainfall and temperature were suitable for the production of various crops, including coffee. Similarly, Chuka Sub-County is characterized by the aspect of a stable radiation surplus climate. The soils in the study area are influenced by Icelandic volcanic soil around Mt Kenya, which are well-drained, well-weathered, deep, and high fertility, facilitating the production of many crops.

2.2. Research design

The study adopted a descriptive cross-sectional research design to obtain data from coffee farmers in Chuka Sub-County. The design was essential as it accommodated for the collection of quantitative and qualitative data. In addition, the research design was vital in offering the researcher an in-depth understanding of the farmer's experience within the time allocated for the field work without manipulating the parameters of the research. The descriptive cross-sectional design also facilitated giving detailed characteristics of the different farmers practicing coffee production in Chuka Sub-County. The study used primary and secondary data, where primary data was collected through structured interviews and questionnaires, while secondary data was obtained from the literature review, i.e., journals. The research and research assistants administered the questionnaires to the farmers in various coffee cooperatives, while structured interviews were used to gather data from various officials in cooperatives such as treasurers, secretaries and managers, and officers serving in the ministry of agriculture (MOA) in Chuka Sub-County. The study tool (questionnaires) sought to determine the impacts of farmers' experience through the number of years of farming, the number of trainings attended, and the number of journals read.

2.3. Sampling and data collection

The study used a total population of 7,428 coffee farmers from different wards of Chuka Sub-County was used. Proportional stratified random sampling was used to acquire a sample of 153 coffee farmers, where 140 responded to the research tool. The study treated each coffee cooperative as a stratum to ease sampling in the three wards. In addition, simple random sampling was applied to obtain respondents from the ten coffee cooperatives (Kabuboni, Kiangondu, Muiru, Kirubia, Gitareni, Magumoni, Thuita, Mwangu, Rebate, and Ndagani) in Chuka Sub-County since the researcher was able to classify the coffee farmers as mutually homogeneous. The study applied Slovin's formula to establish the coffee farmers' strata sample size.
The study applied Slovin's formula to establish the coffee farmers' strata sample size.

$$n = N \div [1+N(e)^2] \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where; n= sample size; N= Population size, e= level of significance; hence,
$n= 7{,}428 \div [1+ 7{,}428(0.08)^2] = 153$

The questionnaires and structured interviews used captured various factors influencing farmer's experiences that affect coffee optimization in the study area. The structured interviews and questionnaires addressed factors within farmer's experience influencing optimal coffee production. This study sought help from Agricultural Extension Office in Chuka Sub-County to ensure validity. Furthermore, Cronbach Alpha was calculated and the study obtained a value of 0.802 which indicated the items included in the questionnaire were worthy. The three fundamental assumption of ethics: respect, fidelity, and confidentiality were followed by the study. Therefore, all data collected during the study was used solely for this proposed study with no reference to

particular individuals. To avoid copyright and plagiarism, all secondary data used was acknowledged and referenced in the report.

2.4. Data analysis

The questionnaires and structured interviews used captured various factors influencing farmer's experiences that affect coffee optimization in the study area. The structured interviews and questionnaires addressed factors within farmer's experience influencing optimal coffee production. This study sought help from Agricultural Extension Office in Chuka Sub-County to ensure validity.

$$X^2cal = \Sigma[(O_{ij} - E_{ij})^2 / E_{ij}] \text{ ……... (2)}$$

Where O denotes the observed frequency while, E represents the expected frequency at column j and row i.

The Chi-square statistic was calculated to establish if it was less or greater than Chi-square tabulated. Adekpedjou *et al*. (2015) reported that if the values for the X^2 calculated were less than the values for X^2 tabulated, the null hypothesis should be rejected and vice versa. In addition, the Logit model was used to analyze the relationship between the variables and the optimization of coffee yield. The association's establishment was essential in establishing the variation that varies significantly between the optimizers and the non-optimizers of yield.

2.5. Logit model specification for optimization

A logit model was applied to deal with the farmer's experience in optimizing coffee yield. The study's dependent variable was optimization, which took the value of 1 or 0. The value for 1 denoted a coffee farmer who optimized yield through his farming experience, while the value for 0 indicated a farmer who did not. Optimizers of coffee yield were defined as farmers whose number of years of coffee farming, the number of trainings attended, and the number of journals reads in the cropping year 2016/2017 and 2017/2018 optimized coffee yield. The non-optimizers were defined as farmers who did not maximize their production in the given cropping season.

Thus, the study adopted the following simple regression model to determine the relationship between the farmer's experience and the optimization of coffee yield.

$$Y_i = \beta_0 + \beta_1 X_1 + u_1 \text{ … … … … … … … … (3)}$$

Where;

Y_i represents for optimization of coffee yield with the value of 1 for optimizers and 0 for non-optimizers

X_1 represents the farmer's experience, denoted by the number of years of farming, training attended, and journal read. u_1 refers to a disturbance term with a mean of zero.

Equation (3) was a typical linear regression model, but because the dependent variable's optimization of coffee yield is binary, it results in a linear probability model (LPM). However, in applying the regression model, keeping in mind that the explained variable is optimization taking the values of 1 or 0, the usage of LPM poses some challenges. Hence, to overcome the challenges posed by the LPM, the study adopted the logit model recommended by Gujarati et al. (2004). The cumulative logistic probability for the coffee yield optimizers was represented by;

$$P_i = \frac{1}{1+e-z} = \frac{e^2}{1+ez} \quad \text{…… (4)}$$

Where; P_i represents the probability that an ith coffee farmer optimized yield, and Pi is assumed to be nonlinear related to Zi

$$Z_i = \beta_0 + \beta_1 X_1 + \text{… … . . } \beta_n X_n + u_1 \text{ … … (5)}$$

Then, (1-P), the probability of the non-optimizers of coffee yield is presented as

$$1 - P_i = \frac{1}{1+e-z} \quad \text{…....…….... (6)}$$

Therefore, by dividing Equation (5) by Equation (6), the study was in a position to obtain the odd ratios in favour of optimization of coffee yields.

The relationship between the farmer's experience and optimization of coffee yield in the study was estimated through the logit model. The explained variable was transformed by taking the natural log of Equation 4, as shown below.

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i$$
$$= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \text{…} \beta_n X_n$$
$$+ u_i \quad \text{… … … … … … … … … … … … … … … … … (7)}$$

Where;
Li is the log of odds ratios, Zi ranges from –∞ to + ∞ , and Pi ranges between 0 and 1
In order to specify the Logit Model, the study adopted Menard's (2002) specification baseline as follows.

$$Y_i = \beta_0 + \beta_1 YEAR + \beta_2 \text{TRAIN} + \beta_3 \text{JOURNAL} + \varepsilon i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where;
Y_1 denotes the log odd ratios of optimization for the i^{it} coffee farmer, β_0 is the intercept, $\beta_1 YEAR$ is the number of years a farmer has been in coffee production, β_2TRAIN is the number of trainings attended that pertains to coffee production, β_3JOURNAL is the number of journals read on coffee production, and εi is the disturbance term.

3. Results and Discussions

3.1. Coffee production

The quantity of coffee produced for the last two years was a significant factor in the study to establish the influence of farmers' experience. The findings of this study showed that the majority of the respondents in Chuka Sub-County, at 50%, produced between 300-399.9 kg per acre of coffee in the crop year 2016/2017. Similarly, in the crop year 2017/2018 majority, 47.9% of the research participants produced between 200-299.9 kg against about 2,300 kgs of coffee attained by other producing nations in the world. The findings showed a deterioration in coffee production in the crop year 2017/2018 compared to the crop year 2016/2017 (Table 1). Further probing revealed that the low coffee production experienced in the crop year 2017/2018 resulted from low rainfall compared to previous years. Rainfall distribution directly affects effective flowering, the prevalence of diseases, and the maturation of coffee cherries. The findings of this study concurred with (van Keulen & Kirchherr, 2021), who argued that low rainfall stresses the coffee bush, is likely to lower the optimization and result in poor quality and quantity of coffee beans. Likewise, the productivity of coffee changes with changes in rainfall, and the drought experienced in Chuka Sub-County in the crop year 2017/2018 affected the overall coffee plant health resulting in declined production.

Table 1. Coffee Production in the Crop year 2016/2017 and 2017/2018 per acre

Quantity (Kgs)	2016/2017		2017/2018	
	Frequency	%	Frequency	%
1-99.9	7	5	12	8.5
100-199.9	15	10.7	17	12.1
200-299.9	40	28.6	67	47.9
300-399.9	70	50	40	28.6
400 and above	8	5.7	4	2.9
Total	140	100	140	100

3.2. Effect of farmers' experience on optimization of coffee production

The study investigated whether the farmer's experience influences the optimization of coffee production. The farmer's experience will be determined by establishing the number of years a farmer has been practicing coffee farming, the number of trainings attended by a coffee farmer, and the number of journals or reading materials a respondent has read.

3.3. Number of years of coffee farming

The findings of the study indicated that the majority of the respondents (42%) had over 20 years, 27.1% had between 16-20 years, 17.8.1% had between 11-15 years, and 9.3% had between 6-10 years, while 2.9% had below five years of coffee farming (Table 2).

Table 2. Number of years of experience in coffee farming

Years	Frequency	Percentage
Below 5	4	2.9
6-10	13	9.3
11-15	25	17.8
16-20	38	27.1
Over 20	60	42.9
Total	140	100

The findings of this study are in agreement with those of Ullah *et al.* (2015) and Nyamwamu (2018), who stated that the majority of farmers had farming experience for more than 20 years and reported that the number of farming years correlates with the farmer's experience. Farmers with few years of coffee farming have low yields per bush hence low optimization of coffee production, which concurred with Ullah *et al.* (2015).

The study also sought to establish whether the coffee farmers had been attending training to

boost their knowledge in optimizing coffee production, where a "Yes" response was used for attendance and “No" for not attending. According to the results, the majority of the respondents, 57.1%, had not attended a single training in the past two years compared to 42.9% who had participated in training on coffee production (Table 3).

Table 3. Coffee optimization training attendance

Training Attendance	F	Percentage
Yes	60	42.9
No	80	57.1
Total	140	100

The majority of the respondents had not attended training in the past two years. This may explain why the farmers in Chuka Sub-County are not attaining standard production of 2300 kg. This study concurs with the findings of Abdi-Soojeede (2018), Temple and Ziegler (2019), and Lyon *et al.* (2018), who reported that the majority of the farmers are less likely to attend the training have a low agricultural production compared to their counterparts. Further, the respondents who had attended the training were asked to indicate the number of training and the influence on the farmer's experience. The findings showed that most of the respondents, 45% attended between 11-20 training in a year. The results also showed that 25% of the respondents had participated in below 10 training, 16.7% attended between 21-30, while 13.3% attended above 30 training on coffee production in Chuka Sub-County (Table 4).

The findings of this study were in agreement with the results of Massimi (2017), who reported that most of the farmers were committed to other economic activities that limited the time scheduled for training.

Table 4. Number of Trainings Attended and the Impact on Farmers

Training	Freq.	%	Impact of training on optimization		
			Yes (%)	No (%)	Impact (%)
Below 10	15	25	18.3	6.7	25
11-20	27	45	35	10	45
21-30	10	16.7	10	6.7	16.7
Above 30	8	13.3	5	8.3	13.3
Total	60	100	68.3	31.7	100

However, the findings contradict the report of Alessi (2017), who stated that most farmers attended any training prepared by government agencies and other NGOs due to the program's benefits. The respondents who attended the training were also asked to indicate whether the training had an impact. The results demonstrated that the majority of the respondents who attended training, 68.3% believed that it positively impacted the optimization of coffee production. Contrary, 31.7% of the respondents indicated that the training had no effect (Table 4). The study established that coffee farmers had access to three ways of training. In case a farmer attended training in the past two years, the knowledge acquired would be used in the subsequent year to optimize coffee production. The first was the cooperative society field day, conducted during the annual general meeting. As a means to increase competitiveness, the different societies also employ extension officers to train farmers at the farm level. Secondly, it was observed that the way through which farmers in Chuka Sub-County access training is through educational tours to the Coffee Research Institute in Ruiru, where they can visit as a group or individually.

The study findings concur with Ghimire (2017) and Mwende *et al.* (2017), who reported that farmers who attended training increased production as the training exposed them to many available production techniques, which are drivers of increased productivity. These researchers further stated that training is a crucial factor that assists farmers in incorporating technological tools and new scientific advancements into their farm operations. The finding of this study showed that training was essential in enhancing coffee farmers' operations. The result was in agreement with Davis (2020) and Alda (2020), who indicated that training enhances farmers' operation, which increases efficiency.

During the study**,** respondents were asked whether they read material related to coffee production to boost their knowledge of optimizing coffee production. This was done using a "Yes" response for reading and a "No" for not reading. It was observed that 87% of the respondents had not read a single article in the past two years, but 20% had read a journal on coffee production (Table 5). The findings concur with those of Biramo (2018) and Singh *et al.* (2019), in their research in Nigeria, who

reported that farmers were reluctant to read journals due to poor reading practice as a result of vocabularies used and farmers who adopted the practice of journal reading had increased crop production.

Table 5. Coffee production journal reading

Journal Reading	Frequency	Percentage
Yes	28	20
No	112	80
Total	140	100

The study sought to establish whether the respondents who read journals felt any impact in their coffee ,82% of the respondents revealed that the practice of reading production materials had a positive impact on coffee yields (Table 6). The findings showed that the majority of the respondents at 71.4%, had read below two journals on coffee production. Also 14.4% of the respondents had read between 3-5 journals,10.7% had read between 6-8 journals, while only 3.6% had read above eight journals. The findings also revealed that 82.1% of the research participants were positively impacted by the practice of reading journal which as essential in optimization of coffee production from the journal they read, while 17.9% believed that it did not impact coffee production. The findings of this study concur with those of Singh & Dhadse (2021) and Lencsés *et al*. (2014), who found that journal reading impacted the farming activities with valuable lessons which were documented from many years of experience in the production of coffee across the world. In addition, the findings concur with those of Alda (2020), who stated that journal reading was a source of farmers' knowledge and made them to adopt new production practices applied in other parts of world.

The practice of journal reading increases coffee farmers' knowledge and equips them with the ability to make production decisions and choices. Hence, this study established that the number of journals read was directly related to knowledge acquired in the production of coffee produced. The absence of the reading materials, especially after the introduction of the County Government in 2013, reduced funds allocated to the MOA, which was used to acquire the articles.

Table 6. Number of journals read and impact on coffee production

No of Journals Read	Freq.	%	Impact of Journal Reading		
			Yes %	No %	Total Impact %
Below 2	20	71.4	57.1	14.3	71.4
3-5	4	14.3	10.7	3.6	14.3
6-8	3	10.7	10.7	0	10.7
Above 8	1	3.6	3.6	0	3.6
Total	28	100	82.1	17.9	100

3.4. Mean agreement of the different factors influencing farmers' experience

The study sought to establish mean agreement of the factors influencing farmers' experience, thereby affecting the optimization of coffee production. Sixty percent (60.3%) of the respondents stated that the few the number of trainings attended, numbers of years of coffee farming, and journal read reduced the farmers' experience (Table 7). The findings of this study revealed that the number of trainings attended influenced the coffee farmer's experience. The findings of this study concur with the those of Zelaya *et al.* (2017), who found that farmers who had produced coffee for many years had more knowledge on practices such as pruning, minimum tillage, fertilizer application rate weeding, and land preparation.

Furthermore, the results of this study concur with the agreement of Alda (2020), who noted the number of journals read by a farmer is positively associated with the level of farmers' experience. The findings contradict an argument of Lencsés *et al.* (2014), who stated that the level of experience derived from the journals is facilitated by the type of journal read. A farmer's level of experience determines the coffee production's optimization level. Experienced farmers understand the different methods that can be applied in the management of the farm.

Table 7. Mean agreement on a scale of 1-5

Factors	Mean 1-5 points	%age	F
The few numbers of years of coffee farming reduce farmers' experience	2.99	59.7	140
The few numbers of training attended reduce farmers' experience in coffee production	3.16	63.2	140
The few numbers of journals read reduces the farmers' experience in coffee production.	2.90	58	140
Total Mean	3.07	60.3	

3.5. Mean Chi-square Coefficients for the Factors Influencing Farmers' Experience in Optimization of Coffee Production

This study sought to determine the association between the number of years of farming, the attendance of training, and the number of journals reads with farmers' experience. The three variables were ranked to establish the means and standard deviations. The findings showed that out of the three factors evaluated, the few numbers of the training attended had the highest association with a chi-square of 36.643 (*M*=3.12, *SD*=1.10). The few numbers of years of coffee farming had chi-square values of 33.714 (*M*=2.99, *SD*=1.116), while the number of the journal read had a chi-square value of 24.21 (*M*=2.90, *SD*= 1.10) (see Table 8). The study's results indicated that increasing the number of trainings increases the optimization of coffee production. The findings concurred with those of Alda (2020), who reported that the farmer's experience is affected by the number of trainings attended. Battista *et al.* (2016) suggested the number of years of farming, training attended, and journal reading. Similarly, the study's findings agree with those of Alessi (2017), who indicated that the number of farming affects farmers' experience. The number of years of farming is essential in determining diseases, pests, and the best timing for weeding, spraying, and harvesting the produce.

Table 8. Chi-square Coefficients for the Factors Influencing Farmer's Experience

Farmers' Experience	Factor	Score
The few numbers of years of coffee farming reduce farmers' experience	Chi-square Value	24.21
	Mean	2.986
	SD	1.1752
	Df	2
The few numbers of training attended reduce farmers' experience in coffee production	Chi-square Value	36.643
	Mean	3.1570
	SD	1.1012
	Df	2
The few numbers of journals read reduces the farmers' experience in coffee production	Chi-square Value	33.714
	Mean	2.900
	SD	1.1013
	Df	2

The study results were presented using maximum likelihood estimation in Table 9. The Table shows the parameter estimates (coefficients) and the marginal effects accompanied by the robust standard errors. The study's findings indicated that the model was reasonably fit, as demonstrated by low Wald chi (24) and log pseudo-likelihood -118.34 (Table 9). The Wald X^2 65.81 (P=0.00) indicated that the three explanatory variables under investigation influenced the probability of optimization of coffee yields in the Chuka Sub-County. Also, the logit model correctly classified the respondents into optimizers and non-optimizers, indicated by a level of 85.23% correct prediction.

The study indicated that coffee yield optimization was mostly done by farmers who had been in the farming practice for many years. The study's findings indicated that the number of years a coffee farmer had was significant at 10% (Table 9). The results of this study were in agreement with Ullah *et al.* (2015), who stated that farmers who have had many years of farming are in a position to develop new production practices that improve production. However, the study's findings contradict the work of Nyamwamu (2018), who noted that the number of years of farming does not influence a farmer's experience; hence, they cannot translate to optimization. The study found that the number of trainings that a coffee farmer attended had a positive and significant relationship with the optimization of coffee yield.

The farmers who had more than 10 training attendances were likely to optimize coffee production by 24.8% at ($p<0.01$) level of significance (Table 9). This suggested that attending training would improve access to information from peers and agricultural experts and understand and analyze production techniques that can improve optimization better than those who attended less.

The findings of this study concurred with Ghimire (2017) and Mwende *et al.* (2017), who argued that more training could enhance the farmers' capacity to acquire, process, and utilize data and information obtained from various agricultural trainers. Similarly, more training enhances the capability of individual farmers to find ways to manage their farm enterprise.

The study found that the number of journals read was negatively significant to the likelihood of optimization. Similarly, Lencsés *et al.* (2014) also reported a negative and significant relationship between journal readings and production. The findings of this study indicated that an additional unit of the journal a farmer read resulted in a decline in the optimization of coffee yield (Table 9).

Table 9. Maximum Likelihood estimates for farmer's experience affecting optimization of coffee yield

Variables	Coef	Robust Std.Err.	dy/dx	Delta Method Std Err
No of Years of Farming	0.0128	0.033	0.001	0.003
Below 5 (yes=1)	2.308	1.581	0.326	0.218
5-10 years (yes=1)	2.143	1.355	0.301	0.189
Over 10 years (yes=1)	2.190	1.243	0.320*	0.187
No Trainings Attended	0.0127	0.021	0.002	0.004
Below 10 Trainings (yes=1)	0.225	0.584	0.032	0.081
10-20 Trainings	0.243	0.451	0.035	0.064
Above 20 Trainings (yes=1)	1.750	0.387	0.248***	0.052
No journal Read	0.0288	0.031	0.002	0.003
Below 2 (yes=1)	-0.983	0.413	-0.131**	0.051
2-8 (yes=1)	-0.005	0.002	-0.001***	0.002
Above 8 (yes=1)	-0.100	0.003	0.0001	0.001
Number of Obvs	140	Prob>chi2		0.000
Log pseudo-likelihood	-118.34	Pseudo R2		0.317
Correctly predicted	85.23%	Wald chi (24)		65.81

4. Conclusion

The study's findings revealed that the number of years of schooling, training attended, and journal read have a significant effect on farmers' experience that influences optimization of coffee production. The study also found that the level of farming experience is one of the biggest challenges that farmers face today as agriculture is changing drastically. Farmers need to undergo thorough training. The fact that many farmers have few years of coffee farming negatively affects optimization. If the coffee farmers are to boost their farming experience, they have to embrace the training and produce the crop for a long time. Provision of training improves farmers' production skills that, in the long run, improve the farming experience. Similarly, the study established that most farmers did not attend the training. The stakeholders in the coffee sector should invest in ensuring that the material offered to farmers during the training is

relevant. Furthermore, farmers should also be trained on the proper utilization of inputs such as fertilizers and the control of pests. Coffee cooperatives can start the capacity building of the farmers through programs that ensure good coffee agricultural practices, such as peer agriculture. However, the study established that the number of journals read does not influence farmers' experience. Finally, the policymakers should promote farmers' experience, which will be essential in adopting new technologies and practices at the farm level.

Conflict of Interest

Authors declare no conflict of interest.

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