East African Scholars Journal of Agriculture and Life Sciences
Abbreviated Key Title: East African Scholars J Agri Life Sci
ISSN 2617-4472 (Print) | ISSN 2617-7277 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-6 | Issue-4 | Apr-2023 | DOI:10.36349/easjals.2023.v06i04.001

Original Research Article

Evaluating Power of Information and Coffee-Variety Choice on Smallholder Farmers' Yields in West of Rift, Kenya

Joseph Kipkorir Cheruiyot[1*], Nelly C. Sang[1]
[1]School of Agricultural Sciences and Natural Resources, University of Kabianga, Kenya

Article History
Received: 14.02.2023
Accepted: 26.03.2023
Published: 15.04.2023

Journal homepage: http://www.easpublisher.com

Quick Response Code

Abstract: Coffee (*Coffea sp.*) is an important crop globally, employing millions along its value chain. It is the second most traded commodity after oil and the most consumed beverage in the world. In Kenya, it is one of the largest foreign exchange earners, grown by about 800,000 smallholder farmers and supporting many livelihoods. Its productivity, however, is hampered by several factors; climate change, pests, diseases, socioeconomic factors and technology adoption levels. Technology adoption is a process in which information acquisition is a prerequisite. The current study investigated the power of information and coffee variety choice on the yields of smallholder coffee farmers in West of Rift, Kenya. The study adopted an ex-post facto survey design and data were collected using semi-structured interview schedules from 140 farmers sampled through purposive and multi-stage sampling schemes. Farmers' Agronomic information were measured using self-evaluation ranking scales (1-10), coffee varieties were separated into 'new' and 'traditional' and reported yields were measured in kilograms of cherry/tree. Descriptive and inferential statistics were used in the analysis, computed by SPSS. Ruiru 11 variety dominated (53%), Batian (22%), K7 (18%) and SL28 (6%). New variety (Ruiru 11 and Batian) growers' had significantly higher agronomic information score than traditional (K7 and SL28) as tested by Mann-Whitney U-test; U (N_1=35, N_2 =14) =143.500, Z = -2.295, P < .05. The 'new' variety growers had significantly higher mean yields compared to 'traditional'; t (47) = 2.108, P = .040. Crop nutrition and canopy management were dominant areas of information needs. In conclusion, farmers with higher self-reported levels of agronomic information preferred new higher yielding disease resistant varieties and recorded higher yields. The linkage between farmers' information levels, variety choice and yields is confirmed. It is recommended, information asymmetries needs to be addressed.

Keywords: Smallholder, Agronomic information, coffee varieties, status quo, diffusion.

INTRODUCTION

Coffee is among the major agricultural plants grown globally. It is grown in more than 80 countries worldwide. The main coffee-producing countries include; Brazil, Vietnam, Colombia and Indonesia. In the year 2017, the largest producers and exporters were Brazil, Vietnam and Colombia, while the largest importers were the United States, Germany and France (Voora *et al.*, 2019). Although some countries like the U.S. and Germany lead in consumption, the beverage is consumed across the world and is recording an increased demand even in non-traditional markets (Khalif *et al.*, 2022). It is among the most traded commodities in the world (Wambua *et al.*, 2021). Available data suggest that it is the second most traded commodity after oil (Mestanza *et al.*, 2023). Coffee is not just traded worldwide to raise income for exporting countries, but, it is consumed in large quantities across the world largely because of its mood-improving caffeine, large amounts of minerals and bioactive compounds with antioxidant activity (Mestanza *et al.*, 2023). Estimates suggest that coffee is the second most consumed drink after water (Ibid). The crop is grown on about 12.5 million farms worldwide, with a majority of them, constituting between 67 and 80% being

***Corresponding Author:** Joseph Kipkorir Cheruiyot
School of Agricultural Sciences and Natural Resources, University of Kabianga, Kenya

smallholder farms in developing countries (Voora *et al.*, 2019). Approximately 100 million coffee value chain actors in the world draw their livelihoods from coffee (Caswel, Mendez & Bacon, 2012). It generates millions of jobs for exporting countries and for importing countries during processing and value addition (Duguma *et al.,* 2021). The main coffee seeds grown in various parts of the world are *Arabica* and *Robusta*. Gathura (2013) categorizes Latin America, Asia and Eastern Africa as the main growers of Arabica coffee (*Coffea arabica*), while Central and Western Africa, Brazil and South East Asia grow *Robusta (Coffea canephora)*. Arabica coffee accounts for 70 per cent of the global production and Robusta coffee accounts for the remaining 30 per cent (Bunn *et al.*, 2015). Coffee is naturally a tropical crop and is grown in Southern America, Asia, Africa and parts of Oceania (Gichuru *et al.,* 2021). In Africa, Ethiopia is the largest producer of coffee. In the 1980s, Kenya was the second largest producer of coffee in Africa, but its production has gone down and is currently ranked fifth (Gichuru *et al.,* 2021). The decline in production has been blamed on several factors including high cost of production, climate change, pests (Gichuru *et al.,* 2021) and the farmers' level of information inputs (Cheruiyot, 2022) among other factors.

Kenya is currently the fifth largest producer of coffee in Africa, coming after Ethiopia, Uganda, Coted'evoire and Tanzania. In terms of foreign-exchange earnings, the coffee sub-sector in Kenya is ranked fifth after tea, tourism, horticulture and Diaspora remittances (Kenya National Bureau of Statistics, 2019), bringing in 3.2% of foreign exchange (IFC, 2023). About 75% of Kenya's coffee is produced by small scale farmers owning 0.3 to 0.5 hectares of land; the rest is produced at the plantation level by large scale farmers (International Finance Corporation, 2023). Recent data indicates that there are now over 800,000 smallholder farmers involved in coffee production and only 6,000 large farms (Gichuru *et al.,* 2021), suggesting a high number of small farm units under coffee and probably a greater need for relevant information for upcoming new smallholder producers. The major growing regions are the high plateaus around Mount Kenya, the Aberdere range, Kisii, Nyanza, Bungoma, Nakuru, Kericho, Nandi and to a smaller scale in Machakos and Taita Hills in Eastern and coast region respectively (Kathurima, 2013). Kenya's high potential land averaging 170,000 hectares is planted with Arabica varieties (SL34, K7, SL28, Ruiru 11 and Batian). These varieties fetch high prices in the world market owing to their good cup quality (Gachimu, 2020). Ruiru 11 and Batian are 'new' coffee varieties that were released by Coffee Research Foundation between 1985 and 2010 and presents new opportunities to farmers due to their exceptional quality, higher yields and tolerance to diseases than the traditional varieties (Diro & Erko, 2019). The higher yield attributes of the new varieties at the breeding stations were expected to translate to higher productivity and production at the smallholder farms and increase the quantity supplied to the markets. Emilola *et al.,* (2016) argues that the quantity of coffee products supplied to the market correlates with the quantity produced, which in turn relates to the use of improved crop varieties. Coffee yields among smallholder farmers in Kenya remain relatively low with an average production of 302kg/ha clean coffee, compared to 556kg/ha for estates (International Coffee Council, 2019). The low coffee yields have been attributed to a number of factors, including; climate change, pests and diseases, volatile prices (Gichuru *et al.*, 2021), as well as socioeconomic factors and technology adoption levels (Wambua *et al.*, 2021).

The coffee yields among smallholder farmers in Kenya can be enhanced by applying information and knowledge on good agronomic practices that address their inadequacies in the cultivation, soil fertility management, crop protection, canopy management and good cherry harvesting practices (Cheruiyot, 2022). A study conducted by Mugwe (2014) revealed that poor agronomic practices leads to low coffee yields and requires the attention of agricultural extension services, suggesting a need for information and knowledge inputs. There has been limited on-farm research to assess the impact of technologies released from research institutions (Wambua *et al.*, 2021). Carpente *et al.*, (2018) observed that there was a lack of information flow between research institutions, marketing system, cooperatives and farmers. Their study indicated that the results from research institutions did not seem to reach the farmers. In the areas to the West of Rift, as in elsewhere in Kenya, there has been diffusion and dissemination of information among the smallholder coffee farmers on good agronomic practices and the potential benefits of the new coffee varieties in improving coffee yields. The current study sought to establish the level of information possessed by the farmers and whether there is a link between the agronomic information they possessed, the coffee-variety choices made and their coffee yields. Whereas information from plant breeding stations assert that the new varieties are high yielding compared to the traditional cultivars, there is an insufficiency of information on their performance in the mixed farming systems operated by the small scale farmers, particularly given that the different varieties require different management practices. This study sought to evaluate the power of information possessed by the farmers and the farmers' coffee-variety choice on coffee yields in the study area. More specifically, the study sought to:

i) Assess the level of adoption of the new coffee varieties among smallholder farmers in the West of Rift.
ii) Establish a link, if any, between the farmers' agronomic information and the coffee varieties grown.

iii) Establish the link, if any, between the coffee variety choice of the smallholder farmers in their contexts and their coffee cherry yields.
iv) Evaluate the information needs of the smallholder coffee farmers in the area of study.

2. METHODOLOGY

2.1 Study Site

The study was carried out in Kericho and Nandi Counties situated in the West of Rift in Kenya. The two counties grow more coffee than other counties in the region. Kericho County covers an area of 2,479 km^2 and consists of six sub-counties (County Government of Kericho, 2013). It has undulating topography with the lowest altitude of 1800m and highest of 3000m above sea level. Temperatures range between 10^0C and 29^0C with an average temperature of 17^0C.The central part of the county receives rainfall of 2125mm while the lower belt receives 1400 mm (CGK, 2013). Long rains are experienced between April and June and short rains fall between October and December with dry months being January and February. The main crops grown in the county are tea, coffee, sugarcane, maize, potatoes, beans, and horticulture. Coffee is grown in the upper midland region.

Nandi County covers an area of 2,884.4km^2.It is characterized by five distinct topographic features; hills, plateaus, volcanic mass, swamps and escarpment. Temperature ranges between 18^0 C and 22^0 C with rainfall ranging between 1300 mm to 1600 mm per annum (CGN, 2018). Long rains season starts in early March and continue up to the end of June, while short rains start in mid-September and end in November. Dry spell is usually experienced from end of December to mid-March. The areas to the East and North East receiving rainfall of 1200mm to 1400mm per annum suitable for maize, sugarcane and coffee (CGN, 2018).

2.2 Study Design and Sampling

Ex post facto research design was used for this study. Sharma (2019) defines this kind of design as one where the researcher starts by observing the dependent variable in a situation where the independent variable has already occurred and cannot be manipulated. It is used to determine a potential cause from already existing effects. The design is preferred by social science researchers because it is less time-consuming, cheap and provides a sense of direction for research hypotheses. In the current study Kipkelion and Tinderet sub-counties in Kericho and Nandi Counties respectively were purposely selected due their intensity of coffee production.

Participants were selected using stratified random sampling techniques, which categorized the population into strata. The technique enabled the grouping of diverse population into similar ones. The population was stratified according to the coffee cooperative society they were registered in. Out of the 12 active Coffee Cooperative Societies in Tinderet sub-county, 4 were selected. In Kipkelion Sub-County, 5 out of 15 active Coffee Cooperative Societies were selected. From each of the selected Cooperative societies in the two sub counties, 10% of the smallholder coffee farmers were randomly picked for the study. The purposive and stratified sampling techniques were used to obtain 140 smallholder coffee farmers that were used to provide the required data.

2.3 Data Collection

A semi-structured interview schedule was used to gather information from 140 respondents. The Test-retest done on the instrument yielded a coefficient of reliability of 0.85.The instrument was administered by enumerators who had certificate in agriculture and were also trained on; exercising rapport and patience with respondents and cross- checking the data provided. Data were collected on the farmers' socio-demographic characteristics, coffee varieties grown and their yields, level of agronomic information possessed by the coffee farmers, perceived benefits and their information needs. The coffee varieties grown were later categorized into 'new' varieties (Ruiru 11 and Batian) and 'traditional' varieties (SL28 and K7).Coffee yield data were later converted into kilograms of cherry per tree and the agronomic information sought on practices such as; soil conservation, planting to harvesting, soil testing, disease control, pruning, crop nutrition and marketing were captured on a ranking scale (1-10) based on the farmers self-reported score.

2.4 Data Analysis

The data gathered were analyzed by the use of descriptive statistics and tests for mean differences. The Levenes' test for homogeneity of variance was used to establish whether the data complied with homogeneity of variance requirements before a standard t-test could be deployed (Laerd statistics, 2018). In situations where the standard t-test could not be used due to violation of the normality requirements the Mann-Whitney *U* test (formulae 1-4) and the non-parametric Kruskal-Wallis tests were utilized.

The Mann-Whitney U-test was computed based on the formula:

$$U_1 = n_1n_2 + \frac{n1\ (n1+1)}{2} - \Sigma R_1 \quad (1)$$

$$U_2 = n_1n_2 + \frac{n2\ (n2+1)}{2} - \Sigma R_2 \quad (2)$$

Where U_1 = Mann-Whitney value for sample 1
U_2 = Mann-Whitney value for sample 2
ΣR_1 = sum of the ranks for the sample 1
ΣR_2 = sum of the ranks for the sample 2
Mann-Whitney U = the smaller of the two values
Thus: U = Min. (U_1, U_2) (3)

The strength of association between the variables was estimated by Eta squared (η^2), based on the formula:

$$\eta^2 = \frac{Z^2}{N-1} \quad (4)$$

All the computations were performed with the aid of SPSS software for windows.

3.0 RESULTS AND DISCUSSION

3.1 Sample Socio-Demographics

The respondents were aged between 21 and 78 years with a mean age of 43 years. The ages were nearly normally distributed as illustrated in Figure 1, with a mean of 43.02, mode of 36 and a median of 42, slightly skewed to the right with a skewness coefficient of .558, but within the tolerable levels for the assumption of normal distribution. There were 67.8% males and 32.2% females. Majority had primary level education (39.6%), 32.1% had secondary level education and 25.5% had college or university certificates. About 2.8% did not have any formal education.

Knowledge of the respondents involved in this study was necessary in order to understand their socio-demographic profiles. With regard to age, the study noted that coffee producers in the study area had an average age of 43 years; it included both the young and the elderly. Elsewhere in Tanzania, Kimaro (2020) reported that youth did not get involved in coffee farming due to cultural norms, high cost of production and low income from the coffee business. A study by Mugwe (2014) in Tetu County, Kenya noted that 18% of the coffee farmers were between the age of 30-40 years while 53% were between 45 and 60 years, suggesting a low involvement of youth in the coffee sub-sector. Another study by Wambua *et al.*, (2019) found that 84.6% of the coffee farmers in Embu County, Kenya, were between 41 and 60 years while 1.1% of them were below 30 years. The general observation on age factor is that most coffee farmers are elderly. With regard to gender, 67.8% of the sampled farmers were males and 32.2% were females. Different researchers have also reported higher percentage of males compared to female coffee farmers in different areas. Mugwe (2014) found 74% males and 26% females being involved in coffee farming in Tetu. Madanda (2018) noted that 82.4% males and 17.6% females were involved in coffee farming in Uganda. All the findings on gender shows that coffee production is a male dominated economic activity. The participants in the study had varied levels of education; 2.8% had no formal education, 39.4% had primary level education, 32.2% secondary and 25.6% college and university level education. This finding suggests that 58.7% of the farmers had secondary level education and above. The findings are at a slight variance with that reported by Wambua *et al.*, (2019), who found that 75.8% of the coffee farmers in their study area in Embu had attained secondary education and above.

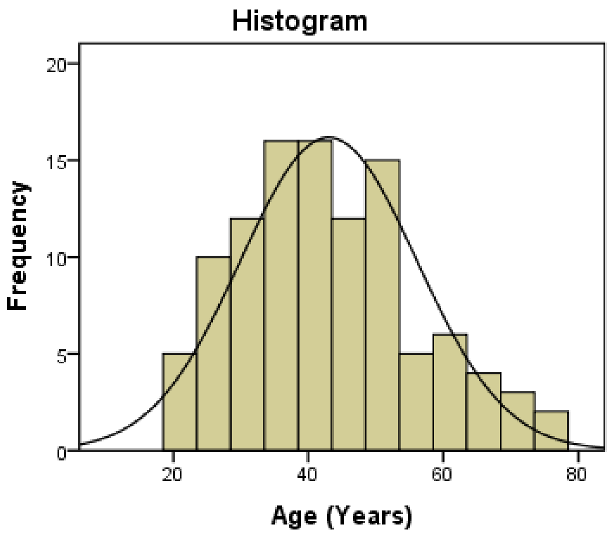

Figure 1: Distribution of chronological age of the respondents

3.2 Coffee Variety Choices

The smallholder farmers had 1 to 4 types of coffee varieties in their farms. A majority had only 1type of variety (63%), 23% had two varieties, 11% had three types and 3% had four. Among the varieties grown, Ruiru 11 dominated with a prevalence of 53%, 22% had adopted Batian variety while 18% and 6% had the traditional varieties of K7 and SL 28 respectively (Figure 2). This observation suggests that Ruiru 11 is a preferred variety among the smallholder farmers in the locality. A total proportion of 73%had adopted either Ruiru 11 or Batian varieties. The two varieties have the superior attributes of being resistant to Coffee Berry Disease (CBD) and Coffee Leaf Rust (CLR) and thus the potential to reduce costs of their maintenance by up to 30% (Coffee Research Foundation, 2014). Khalif *et al.,* (2022) observed similarly that among the Arabica genomes, Ruiru 11 was a common clone as it thrives well at altitudes of 1400 to 2,000 metres.

The current finding differs with that of Mugwe (2014) who reported that only 6% of the farmers adopted improved cultivars of Ruiru 11 and Batian in a study conducted in Tetu constituency in the East of Rift. This difference may be attributed to spatial and temporal differences between the two studies. Whereas the current study was carried out in 2022 and in fairly new coffee growing region to the West of Rift, that by Mugwe (2014) was carried out in a traditional coffee growing area to the East of Rift where traditional varieties may have long been established before the release of the new varieties. Harrison *et al.,* (2019) has argued that farmers with established traditional varieties find it expensive to uproot and to wait for four to five years for the new cultivar to reach productive stage. This apparently rational behaviour may be partly responsible for the low adoption of new varieties in the traditional coffee growing zones to the East of Rift. In another study conducted in a traditional coffee growing region in the East of Rift by Wambua *et al.,* (2019), it was reported that 38.2% of the sampled farmers had planted Ruiru 11 and Batian; implying that these improved varieties had low adoption in the study area. All the traditional coffee varieties are susceptible to major coffee diseases; these Arabica cultivars were first released in the 1930s after selections based on yields, bean size and liquor quality (Gichimu, 2014) and are widely grown to date. Wambua *et al.,* (2021) in their study conducted in Embu County, Kenya, reported that 67.2% of farmers were still dependent on the traditional varieties (SL28, SL34 and K7) that were low yielding and susceptible to fungal diseases. An outbreak of fungal diseases in the 1960s led to breeding programs culminating in the release of disease resistant varieties; Ruiru 11 released in 1985 and Batian released in 2010 (Gichimu, 2020). In a neighbouring country of Ethiopia, Diro and Erko (2019) reported adoption rate of improved cultivars at 53.56%, suggesting similarly that there are many smallholder producers who are still dependent on the traditional varieties.

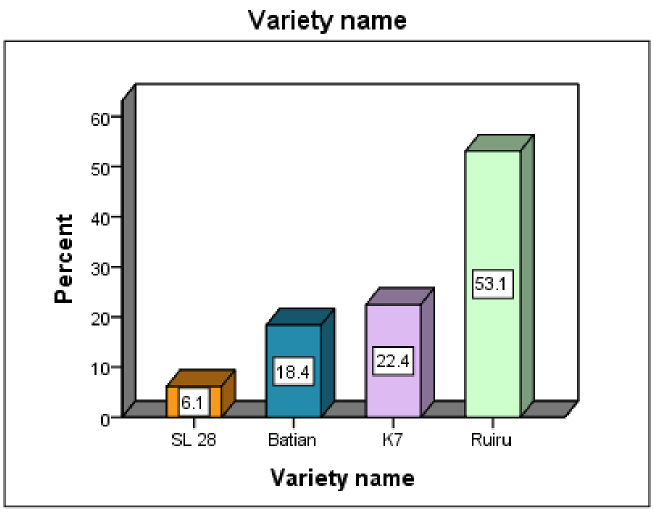

Figure 2: Coffee varieties grown as reported by the respondents

3.3 Agronomic Information and Coffee Variety Choices

A self-evaluation score was administered to establish the level of agronomic information on coffee varieties and the benefits of varieties grown for each farmer. The scores were measured on a ranking scale from 1 (very low) to 10 (very high). The respondents were disaggregated into "New variety" growers and "traditional variety" growers. Those farmers who had more than one type of variety were excluded from this dichotomous categorization. A comparison to test for any differences in their agronomic information mean ranks was analyzed by the Mann-Whitney U-test (formulae 1, 2 and 3).

The Mann-Whitney U test computed by SPSS showed that the distribution of the agronomic information across the two categories; ("New variety" & "Traditional") were significantly different, U (N_1 = 35, N_2 = 14) = 143.500, Z = - 2.295, P < .05. The median scores were higher for the new variety growers (*mdn* = 8.00) compared to the 'traditional' variety growers (*mdn* = 7.00) and the difference was significant (P = .022). A Kruskal-Wallis test for differences in scores confirmed the same, H (1) = 5.269, P = .022.This observation indicates that the choice of the variety grown by the farmer is closely linked to the agronomic information held and used by the farmer. The strength of association was estimated by computation of Eta squared (η^2), based on formula (4), thus, $\eta^2 = \frac{(2.295)^2}{49-1}$ = 0.1097. The observed Eta- squared value of about .11 suggests that about 11% of the variation in information levels could be explained by the category of the farmer. This indicates a middle level strength of association between the farmers' category (New or traditional variety growers) and the information levels.

According to the Diffusion of Innovation Model proposed by Rogers in 1962, the first step towards adoption of new technology or practice, such as the adoption of new varieties is the acquisition of information (Kaminski, 2011). The link between the information levels of the farmers with the adoption of Ruiru 11 and Batian varieties is in tandem with this long-held established theory. The finding suggests a gap on the availability and use of quality information on coffee varieties and their benefits. It suggests a need for agricultural extension intervention for information parity among the small scale farmers to be achieved.

3.4 Variety Choice and Cherry Yields

The growers of the 'new' variety had a mean yield of 3.371± 2.146 kg of cherry per tree. The group with traditional varieties had a mean of 2.11± 0.9342. The mean yields were significantly different based on t-test; t (47) = 2.108, P = .040. A test for homogeneity of variance using the Levene's test, however, showed that the equality of variance assumption required before conducting a t-test did not hold (P = .019), this is further evident from the distribution curve exhibited in Figure 3. The distribution of yields appears highly concentrated near the mean and skewed to the right. The t-test results therefore could not be entirely trusted (Laerd statistics, 2018). Consequently a non-parametric test based on Mann-Whitney U test was conducted to test the null hypothesis that the distribution of the yields was the same across the two categories of varieties ('New' and 'traditional').

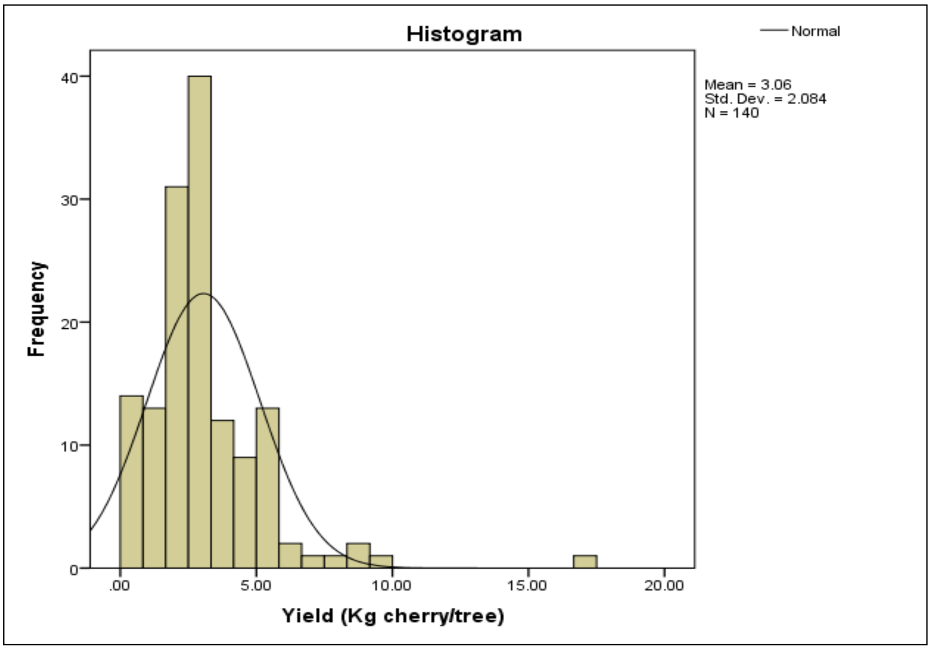

Figure 3: Distribution of cherry yields per tree among Respondents

The *U*- statistic was computed by the use of SPSS. The test result rejected the Null hypothesis of no difference in yields; U (N_1 = 35, N_2 = 14) = 153.500, Z = -2.029, P = .042. This confirmed that the yields differed significantly between the farmers who grew traditional varieties (SL28 and K7) with those who had established the new varieties of Ruiru 11 and Batian. The new varieties had a significantly higher yield, as shown by a higher median (*mdn* = 2.9) compared to traditional (*mdn* = 2.25).

To establish the size of the effect of variety selection on yield performance, Eta Squared (η^2) was worked out, thus, $\eta^2 = \frac{(2.029)^2}{49-1} = .086$. The Eta squared value of .086 suggests that 8.6% of the variability in coffee yields may be attributed to variety choice. According to Cohen (1988) the value represents a medium strength effect size. Studies by Minai, Nyairo and Mbataru (2014) and Muriithi (2016) found a positive relationship between household income and adoption of improved coffee varieties; this implies a higher productivity from the new variety adopters. The current study similarly finds an improved productivity, under smallholder management practices, from the adoption of improved varieties as illustrated in Figure 4. The higher yields associated with the decision to grow new varieties implies that the envisaged increased productivity with the adoption of the new disease resistant, higher yielding varieties is realizable at the diverse production conditions of the smallholder farmers. Despite the high heterogeneity in the management practices of the small scale farmers, in aggregate terms there is higher productivity associated with the new varieties. In a neighbouring country of Ethiopia, Diro and Erko (2019) reported that adopters of improved coffee varieties had a higher mean yield of 861kg/ha of clean coffee, compared to 646kg/ha for non-adopters. Like in the current study, the new varieties were bred for higher tolerance to major coffee diseases and higher cup quality.

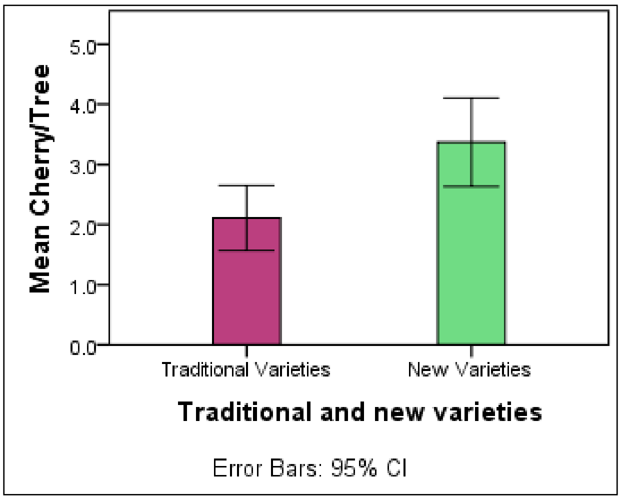

Figure 4: Variety type and yields as reported by Respondents

3.5 Farmers' Agronomic information, Variety choice and cherry yields

The agronomic information levels between categories based on variety choice were significantly different in favour of the new variety growers. The cherry yields were also significantly different based on the categories of the growers with the new variety growers recording higher yields. This observation indicates that the new variety growers had the two attributes of higher agronomic information and higher cherry yields compared to the traditional variety growers. It suggests a link between the ranks on agronomic information with the category of coffee varieties grown and the coffee cherry yields as demonstrated in Table 1. The indications are that there is a significant contribution of information stock on coffee production. The differences between the two categories of growers have implications on the eventual yield and ultimately household incomes.

Table 1: ***Differences in Farmers' level of information and cherry yields based on coffee variety category***

Variable 1	Variable 2	*U*	*Z*	η^2	*P*
Variety: New and Traditional (N_1 =35,N_2 =14)	Agronomic Information	143.500	-2.295	.1097	.022
	Cherry yields (kg/tree)	153.500	-2.029	.086	.042

Perceived benefits of the varieties grown

The farmers had been asked to rate the benefits gained from the varieties they grew on a scale of 1 to 10. Interestingly there was no significant difference in statistical terms between new variety and traditional variety growers; mean of 7.77±1.699 and 7.57±1.697 respectively; t (47) = .372, P > .05. This suggests that the farmers had confidence on the variety they grew irrespective of their differences in yield and other attributes. Although the farmers who grew traditional varieties tended to report that they were not adequately equipped with agronomic information, this finding of equal satisfaction between 'New' and 'traditional' variety growers suggest some form of unwillingness to change to the new varieties. It suggests that the traditional variety growers (SL28 andK7) probably see some positive attributes in these traditional varieties. It seems to indicate that they are contented with the varieties they grow and would probably prefer to maintain the status quo. Some studies in the social sciences point out that peoples' unwillingness to change when exposed to new technologies may be as a result of a status quo bias. The status quo bias is a cognitive bias, a cognitive misconception that prevents one from making new decisions out of fear or aversion to loss. The bias leads to a preference to stay with the current situation (Kim and Kankanhalli, 2009).This maybe the case.

Some of the comments solicited from the study participants through unstructured questions suggest that the K7 variety was viewed as having some positive attributes like tolerance to drought and stable yields. These arguments by the farmers appear to be in conformity with the principle of relative advantage as recognized by the Diffusion of innovation theory (Rogers, 1983). The theory holds the view that potential adopters of technology have to evaluate the advantages of the new technology as compared to the old practice before any adoption can be effected (Rogers, 1983). It further suggests that some segments of society take a longer time to put into effect this process. This may be the case in the adoption of the new coffee varieties. Some few cases, however, may be attributed to their having been established when the new varieties were not available as suggested by a few farmers on their comments on the challenges they face. The farmers pointed out that changing over from the long-established traditional coffee varieties to the new ones is a costly decision that involves complete up-rooting of the old and replacing with the new. According to the farmers, the alternative method of top-working the old with the new varieties is equally costly. These arguments, brought forth by the participants suggest a behaviour that seems to conform to the status quo theory. The theory posits that potential adopters of new technology weigh the perceived losses of switching over to the new technology against the perceived benefits, but there is a cognitive bias where the losses of switching over appear larger than they really are (Kim & Kankanhalli, 2009). Owing to the bias, the combined perceived transition costs, uncertainty costs and sunk costs (forgone investments) are made to appear larger than the perceived benefits (Kim & Kankanhalli, 2009). The argument is that people do not want to forgo their past investments; they are averse to losses and would rather maintain the status quo than switch over to the new technology. It can be argued that this phenomenon may be partly responsible for the apparent non-adoption of the new coffee varieties by some segments of the smallholder coffee producers.

3.6 Farmers' Information-needs

This study further sought to establish information-related challenges faced by the farmers; particularly in regard to routine crop management and variety selection. Data on this specific objective was captured qualitatively and aggregated to establish the frequency of their occurrence. These are treated as areas of information-needs. The information needs could be broadly categorized into: Coffee nutrition information, Pruning/ grafting /handling (canopy management), disease control, soil testing, variety-related, harvesting/marketing, planting-to-harvest and soil-conservation related. The low frequency with which the variety-related challenges emerged (Table 2) indicates that the farmers appeared to prioritize other information needs apart from the variety-related. It may as well have been captured when they express needs for information for the entire value chain; from planting to harvest as expressed by a majority of 40.2%. The needs for information in coffee farming is understandable, as argued by Kabita *et al.*, (2021), access to information raises farmers knowledge and aids them in decision-making so as to increase productivity.

Table 2: *Information needs as expressed by the interviewees*

	Information Needs	Proportion (%)
1	Coffee nutrition information	23.5
2	Pruning/ grafting /handling (canopy management)	23.5
3	Disease control	4.9
4	Soil sampling and testing	2.0
5	Variety related information	2.0
6	Harvesting /grading and market related	2.9
7	General – planting to harvest	40.2
8	Soil conservation related	1.0

The information needs captured as illustrated in Figure 5 suggests that a majority of the farmers are in need of the entire package of crop management (40.2%), while among the specific areas; crop nutrition (23.5%) and pruning/grafting & handling or canopy management (23.5%) are areas of priority information-needs amongst the farmers. Janus (2016) as cited by Kabita *et al.*, (2021) asserts that agricultural practice needs to be supported by information and knowledge to realize productivity. In their study most farmers desired information on coffee nutrition; at 33.3%, control of pests and diseases at 27.8% and canopy management at 13.0%. The prevalence of information needs for pest and disease control at 27.8% as compared to a low of 4.9% in the current study may be largely attributed to geographical locations; whereas their study was carried out in a traditional coffee growing zone of Kiambu where traditional varieties that are prone to diseases dominate, the current study was carried out in fairly non-traditional coffee growing areas where new varieties dominate.

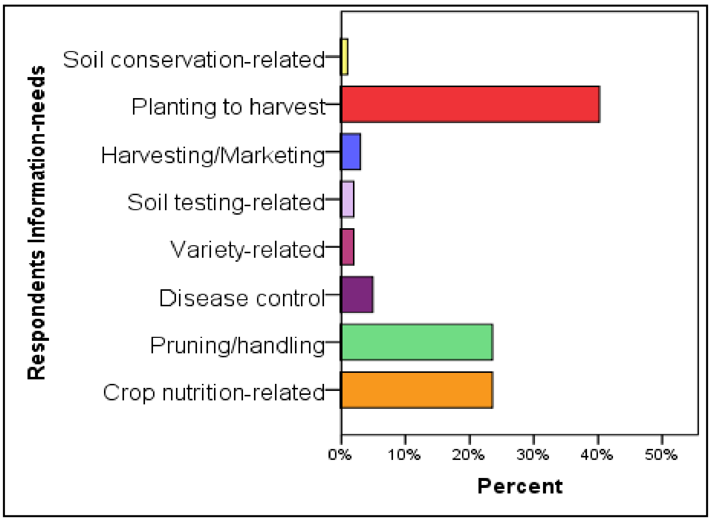

Figure 5: Distribution of Participants' Information-needs

CONCLUSION

The agronomic information held by the farmers had a significant link to the varieties of coffee grown by the smallholder farmers. The varieties grown on the other hand have implications on coffee yields. Farmers with higher levels of relevant information tended to prefer higher-yielding, disease resistant varieties, Ruiru 11 and Batian. This is in tandem with the long-held theory of information-first-technology-adoption-follows as expounded by the diffusion of innovation model. The power of information is demonstrated by the yield differences associated with information. It is recommended that information asymmetries amongst the small-scale farmers be addressed through consistent technical information-input supply on coffee agronomic best practices by extension agents.

REFERENCES

- Bunn, C., Läderach, P., Ovalle Rivera, O., & Kirschke, D. (2014). A bitter cup: climate change profile of global production of Arabica and Robusta coffee. *Climatic Change*, *129* (1-2), 89-101. Available: https://doi.org/10.1007/s10584-014-1306-x
- Carpente, A., Hansen, C., McKee, D., Friborg, K., & Van der Schot, J. (2018). Concerns of smallholder coffee farmers in Gatugi, Kenya. University of Copenhagen. Available: https://sluse.dk/project/kenya_Gatugi_concers_of_smallholder_coffee_farmers.pdf
- Caswell, M., Méndez, V. E., & Bacon, C. M. (2012). Food security and smallholder coffee production: Current issues and future directions. ARLG Policy Brief # 1. *Agroecology and Rural Livelihoods Group (ARLG)*, University of Vermont Burlington, USA. Available: http://www.uvm.edu/~agroecol/?Page=Publications.html
- Cheruiyot, J. K. (2022). Farmers' Information - inputs and their Sway on Coffee Productivity in the West of Rift, Kenya. *Journal of Applied Life Sciences International*, *25*(2), 1–14. https://doi.org/10.9734/JALSI/2022/v25i230282
- Coffee Research Foundation, CRF. (2014). Coffee Growers' Handbook, 1st Ed. Coffee Reasearch Foundation, Ruiru, Kenya
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences*. New York, NY: Routledge Academic
- County Government of Kericho (2013). First County integrated development plan: 2013-2017.Republic of Kenya.
- County Government of Nandi (2018). County integrated development plan: 2018-2023. Republic of Kenya.
- Diro, S., & Erko, B. (2019). Impacts of Adoption of Improved Coffee Varieties on Farmers' Coffee Yield and Income in Jimma Zone. *Agricultural Research and Technology Open Access Journal, 21*(4), 1-9.
- Duguma, L. A., Muthee, K., Carsan, S., Muriuki, J., Bulitta, B. J., Ayana, A. N., Kibugi, R. M., & Suleman, K. K. (2021). Innovation pathways in the coffee sector in Ethiopia and Kenya. In Minang PA, Duguma LA, van Noordwijk M, Eds. 2021.Tree Commodities and Resilient Green Economies in Africa. World Agro-forestry (ICRAF), Nairobi, Kenya
- Emilola, C. O., Adenegan-Kemisola, O., & Alawode, O. (2016). Assessment of Crop Commercialization among Smallholder Farming Households in Southwest Nigeria. *International Journal of Scientific Research in Science and Technology*, 2(6), 478-486.
- Gathura, M. N. (2013). Factors affecting small-scale coffee production in Githunguri District, Kenya. *International Journal of academic Research in Business and Social Sciences*, 3, 1-7.
- Gichimu, B. (2020). Kenyan Coffee Varieties: A comprehensive overview of the top varieties [Online]. Available: https://www.trabocca.com/coffee-knowledge/0rigin/kenyan-coffee-varieties-a-comprehensive-overview-of-the-top-varieties/
- Gichimu, B. M. (2014). Coffee sustainability in Kenya: Role played by improved varieties. Conference paper, September, 2014. Available: https://www.researchgate.net/publication/281626727
- Gichuru, E., Alwora, G., Gimase, J., & Kathurima, C. (2021). Coffee Leaf Rust (Hemileia vastatrix) in Kenya: A Review. *Agronomy*, 11, 2590. https://doi.org/10.3390/agronomy11122590
- Harrison, M., Beatrice, S., Hudson A., Dawson N., & James, M.M. (2019). Improvement in coffee production and economic gains by the farmers through support of coffee cooperative societies in Kenya. *Journal of Agricultural and Crop Research, 7*(4), 47-54. DOI:10.33495/jacr_v7i4.19.111
- International Coffee Council, ICC (2019). Country coffee profile: Kenya. International Coffee Council 124th session, 25th -29th March, 2019, Nairobi, Kenya. International Coffee Organization; 2019. Available: https://www.ico.org/documents/cy2018-19/icc-124-7e-profile-kenya.pdf
- International Finance Corporation, IFC (2023). Sustainability: Improving the productivity of smallholder coffee farms in Kenya [online]. International Finance Corporation, World Bank Group. Available: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/improving_productivity_smallholder_coffee_farms_kenya
- Kabita, E., Kwanya, T., & Mbenge-Ndiku T. (2021). Knowledge Sharing Strategies between Coffee Farmers and Coffee Research Institute: A Case Study of Gitwe Farmers' Co-Operative Society. *International Journal of Management, Knowledge and Learning*, *10*(2021), 157-175.
- Kaminski, J. (2011). Diffusion of innovations: Theory in Nursing Informatics. *Canadian Journal of Nursing Informatics*, *6*(2), 1–7.
- Kathurima, C. W. (2013). Characterization of the Diversity of Coffee Genotypes in Kenya by

Genetic, Biochemical and Beverage Quality Profile [PhD thesis]. Jomo Kenyatta University of Agriculture and Technology, Kenya.

- Kenya National Bureau of Statistics (2019). Economic survey Report, 2019. Kenya National Bureau of Statistics, Nairobi, Kenya. Available: www.knbs.or.ke
- Khalif, M., Abong, G. O., & Okoth, M. W. (2022). Influence of Quality Characteristics and intake of Acrylamide by Consumers of Roasted Coffee in Kenya: A Review. *Current Research in Nutrition and Food Science*, *10*(2), 47-57.
- Kim, H., & Kankanhalli, A. (2009). Investigating User Resistance to Information Systems Implementation: A Status Quo Bias Perspective. *MIS Quarterly*, *33*(3), 567-582.
- Kimaro, P. J. (2020). *Analysis of influence of livelihood capabilities on coffee production among small-scale coffee farmers in Hai and Arumeru Districts,Tanzania* [Doctoral dissertation],Tanzania, Sokoine University of Agriculture
- Laerd Statistics (2018). Independent t-test in SPSS Statistics. Lund Research LTD. Available: https://statistics.laerd.com/spss-tutorials/independent-t-test-using-spss-statistics.php
- Madanda, B. (2018). Factors Influencing Coffee Production by Small Scale Farmers in Busulani Subcounty and Budadiri Town Council in Sironko District. *Afribary*. Retrieved from: https://afribary.com/works/factors-influencing-coffee-production-by-small-scale-farmers-in-busulani-subcounty-and-budadiri-town-council-in-sironko-district
- Mestanza, M., Mori-Culqui, P. L., & Chavez, S. G. (2023). Changes of polyphenols and anti-oxidants of Arabica coffee varieties during roasting. *Frontiers in Nutrition*, 26th January, 2023. DOI: 10.3389/fnut.2023.1078701
- Minai, J. M., Nyairo, N., & Mbataru, P. (2014). Analysis of socio-economic factors affecting the coffee yields of smallholder farmers in Kirinyaga County, Kenya. *Journal of Agricultural and Crop Research*, *2*(12), 228-235.
- Mugwe, J. W. (2014). Factors Influencing Coffee Production By Small Scale Farmers: A Case Of Tetu Constituency, Kenya. [Master’s thesis]. Kenya, University of Nairobi.
- Muriithi, L. W. (2016). Impact of coffee certification on small holder coffee farming in Embu County, Kenya. (*Doctoral dissertation, Kenyatta University*).
- Rogers, E. M. (1983). *Diffusion of innovations* (3rd Ed.). New York: The Free Press.
- Sharma, S. (2019). Experimental and Ex Post Facto Designs [PhD Thesis]. Horizons University, Paris. Retrieved from: https://www.researchgate.net/publication/333220493
- Voora, V., Bermúdez, S., Larrea, C., & Baliño, S. (2019). Global Market Report: Coffee. *Sustainable Commodities Marketplace Series 2019*. International Institute for Sustainable Development, IISD.
- Wambua, D. M., Gichimu, B. M., & Ndirangu, S. N. (2021). Smallholder Coffee Productivity as Affected by Socioeconomic Factors and Technology Adoption. *International Journal of Agronomy, 2021*, Article ID 8852371. Available: https://doi.org/10.1155/2021/8852371
- Wambua, D. M., Ndirangu, S. N., Njeru, L. K., & Gichimu, B. M. (2019). Effects of recommended improved crop technologies and socio-economic factors on coffee profitability among smallholder farmers in Embu County, Kenya. *African Journal of Agricultural Research*, *14*(34), 1957–1966.

Cite This Article: Joseph Kipkorir Cheruiyot & Nelly C. Sang (2023). Evaluating Power of Information and Coffee-Variety Choice on Smallholder Farmers’ Yields in West of Rift, Kenya. *East African Scholars J Agri Life Sci*, *6*(4), 81-90.