

## LEVEL OF KNOWLEDGE AND ITS APPLICATION BY COFFEE FARMERS IN THE UDEEN AREA, GOVERNORATE OF IBB - REPUBLIC OF YEMEN

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### ABSTRACT

This study estimated the knowledge and its application by coffee farmers in Udeen, Ibb Governorate, Yemen. A total of 200 farmers, representing 86% of the coffee farmers, were interviewed using a questionnaire. Percentages, arithmetic means, standard deviations, and Pearson correlation coefficients were calculated. Approximately 51% of respondents had low and 6.5% had high levels of knowledge, and 49% of the respondents showed low and 12.5% respondents exhibited high knowledge application rates. Positive correlations were found between the degrees of knowledge and its application, educational qualifications, land tenure, area under coffee cultivation, extension service satisfaction, and exposure to sources of information ( $P < 0.01$ ). However, there was a negative relationship for the age of the respondent and type of tenure ( $P < 0.01$ ). There was no significant relationship for the number of family members, occupation, other agricultural activities, annual income from the coffee crop, and full-time agricultural work. The results suggest a need to increase extension activities to bridge the knowledge gap and improve application rates. Agricultural programs need to be developed for the coffee growers. Finally, agricultural extension programs through television and radio could raise the awareness of the importance of coffee in Yemen.

**Key words:** Coffee production, Constraints, Extension education, Radio and TV programs, Entrepreneurship.

### INTRODUCTION

The agricultural sector remains one of the most productive components of the Yemeni national economy. Other key sectors also depend upon agriculture as it supplies many goods, food items, and raw materials to these industries. Agriculture ensures food security, helps improve the trade balance, and strengthens integrated rural development efforts. In addition, the agriculture sector helps stabilize the population by reducing internal migration and its interrelated social and economic problems (NASS, 2012). The agriculture sector is a cornerstone of the economy and makes a substantial contribution (17.5%) toward GDP (Central Statistics Office, NASS, 2012). Between 2000 and 2005, it was a source of income for about 74% of the population (Yemen's Development Plan for Poverty Reduction, 2006–2010), and it sustains nearly 2 million workers and employs nearly 53% of the total workforce in the country (IFAD, 2010; Ministry of Agriculture and Irrigation 2010). In the past, Yemen was reasonably self-sufficient in cereal crops; however, because of several constraints, it now imports over 75% of the population's food requirements. Approximately 75% of the population still lives in rural areas (FSIS, 2015), and they meet their food requirements from as little as 3% of the arable land (IFAD, 2010). Agricultural crops cover an area of around 1.20 million ha (82.7% of the total area). Sorghum, maize, millet, and pulses are the main food crops grown

in the republic (New Agriculturist, 2010). However, an estimated 33,260 ha, covering slopes and terraces on high ground (700–2400 m above sea level) and most of the valleys with wet and warm climates, have been allocated for milk production in addition to farm crops (NASS, 2012).

Traditionally, the country produced premium quality coffee and its cultivation has been crucially important for centuries (IFAD, 2010). However, today it has been replaced with a plant named "Qat," which has become the main cash crop. Qat (*Catha edulis*) is a mild stimulant chewed by about 70% of the males in the country (MAI & FAO, 2008; NASS, 2012; GAFSP, 2013).

Today, Yemeni coffee is harvested from ancient types of *Coffea arabica*, which is grown in areas such as Bani Matar, Haraz, internal and external Alehimtin, Bani Hammad, and Udeen. Since the crop has evolved locally over centuries, most of the varieties are not grown anywhere else in the world. In Yemen, different coffee varieties are known by their local names, but they still share some common features and characteristics. However, the taste may vary and the beans often differ in their appearance. In many cases, varieties have never been systematically identified, characterized, or documented. Usually, they are identified primarily by the region in which they are grown, which is why the names of the local coffee varieties in Yemen are irregular (Giovannucci, 2005).

Yemeni coffee is sold under different names, based on the areas where it is grown. Most scientists agree that there are four main varieties: Udaini, Dawairi, Tufahi, and Bura'ai. According to the survey and classification by Qaid (1993), most of the Yemeni coffee plants comprise of these four main varieties. However, the Coffee Research Unit established by the Ministry of Agriculture based in Taiz region, suggests there may be a potential fifth basic variety called Abu Sura. In 2004, Al-Hakimi and Allard (2005) reported that Yemen has six main varieties. However, many of the local types closely resemble the Udaini variety, which suggests that this variety could be the oldest coffee landrace in Yemen. However, Al-Monitor (2014) noted that the most famous types of coffee are Mattari, Yafei, Haimi, Hirazi, Ismaili, Ahjuri, Mahweet, Buraai, Hammadi, Raimi, Wasabi, Anisi, Odaini, Sabri, and Saadi.

Coffee is grown in valleys, where the climate is warm and wet, and on mountain terraces at altitudes ranging between 700 and 2,400 m. IFAD, (2010) maintains that around one million Yemenis work in coffee production. USAID (2005) noted despite Yemen employs traditional methods, centuries old varieties and the water shortage, yet it manages to produce good quality coffee (*Coffea Arabica*)

About 100,000 rural smallholders are engaged in coffee production, representing 9.0% of all farming households (IFAD, 2012). According to USAID, 2005, about 99,056 farmers in the 14 governorates of the Republic, including Ibb, grow about 15,101,903 million coffee trees. The Ibb governorate is ranked at 10 and cultivates 361,059 trees representing 2.39% of the total number of plantations in Yemen (Statistics and the Ministry of Agriculture, 2012).

Yemeni coffee is renowned worldwide for its excellent quality and has been ranked second only to Jamaica Blue Mountain (FAOSTAT, 2012). It, therefore, is sold at prices higher than that of coffee from other countries. Yemeni coffee enjoys a highly lucrative market by fetching double the price for the same quality produce imported from Costa Rica, Guatemala, and Kenya. Approximately 11 countries regularly import green coffee beans from Yemen. Present Yemeni coffee exports vary from 4,000 to 6,000 MT/year and are valued at about USD 20 million, but this has decreased from 12,000 MT/year in the 1950's (IFAD, 2012).

Coffee production in Yemen reached about 19,000 MT in 2012, which is unassertive compared to that of other coffee producing countries. Yemen produced 14,000 and 11,000 MT in 2009 and 2004, respectively, despite all the obstacles limiting the production and trade in Yemeni coffee. The coffee is exported to the Gulf States, Japan, United States, Canada, Russia, France, Italy, Denmark, Germany, Turkey, and India (Ministry of Agriculture and Irrigation, 2012).

Today, coffee is grown in almost all regions of the country (Al-monitor, 2014), and in the past, Yemen was one of the leading coffee producing nations. However, today it has lost its prime position in terms of global quality, but in terms of volume, Yemen still occupies the first place at the global level by producing up to 21% of the total global production. Among the other major coffee producing countries, Colombia, Ethiopia, and Uganda occupy prominent positions by producing 12%, 4.4%, and 4% of the world's production, respectively. In Asia, Indonesia contributes to about 5.4%, followed by Vietnam at 4.6%, and India at about 3.7% of the total global production (Al-Shehri, 2011).

Several factors have been identified as being responsible for the sharp decline in coffee production and its subsequent export in the Republic of Yemen. The most important are (i) irregular water supply and/or drought to which coffee trees are highly sensitive; (ii) insufficient strategic focus and investment across the value chain; (iii) limited research and extension for coffee farmers; (iv) absence of transparent marketing systems; (v) breakdown of the standardization system; and (vi) lack of branding. These problems and constraints alone or in combination have resulted in low productivity and reduced revenues. However, the most important factor could be lack of knowledge and its application and the use of traditional cultivation techniques and production technologies. Al-monitor (2014) notes that despite the obstacles associated with coffee production, Yemen can regain its export position.

Kashtah (2012) maintains that the aim of agricultural extension is to help farmers understand and apply new agricultural techniques and appropriate technologies by bringing desired behavioral changes. Extension education helps farmers to adopt appropriate methods through guidance programs that aim to help farmers gain new knowledge and to achieve practical change. However, Swanson *et al.* (1998) are of the opinion that the Agricultural Extension Policy should be part of the national development policy in general and agricultural and rural development policy in particular. Similarly, Jones (1986) believes that agricultural extension remains an integral part of agricultural development.

Information sources in enhancing farmers' knowledge in general and coffee farmers' in particular are considered to be extremely important. Badawi and Saad Eddin (2006) reported that radio programs positively enhanced respondents' knowledge about coffee production. The respondents in their study believed that radio programs held "great promise" as a source of agricultural knowledge about coffee crops. Similarly, Abbas (2007) reported that higher level of contact that the farmers had with extension programs resulted in higher level of knowledge, which was then reflected at the social and economic level.

The study by Bailly (1971) showed that media sources have an important role in providing essential and timely information to farmers. It revealed that respondents using media sources had high awareness levels. Similarly, Shaibah (1994) reported that approximately 55% respondents believed that extension TV programs are one of the most important sources of agricultural knowledge and information. However, there is a need to assess the role of radio and TV extension programs in enhancing farmers' knowledge. This study aimed to evaluate the knowledge and application levels of farmers in the coffee area of Udeen in the Republic of Yemen.

The findings of this study could help decision makers to develop outreach programs for farmers in the study area and inform further, similar studies in other parts of Yemen. In addition, the study could help restore the agricultural status of the region and improve the coffee production process in the republic so that it remains a world leader in coffee production.

**Objectives of the study:** The objectives of the study were as follows:

1. To identify the cognitive level of the agricultural operations undertaken by the coffee crop growers in Udeen.
2. To determine how well the knowledge on new agricultural technical operations related to coffee production had been implemented by the respondents in the study area.
3. To study the nature of the correlation between various independent variables and a dependent variable which has been defined as the degree of knowledge held by farmers and its effect on agricultural operations.

## MATERIALS AND METHODS

**The study area:** The study was conducted in Udeen area, located in the south-west of the province of Ibb, Republic of Yemen (Fig. 1). Agriculture is the main activity of the population; and coffee is one of the most important crops produced in Udeen area. Other crops grown include maize, sorghum, sugar cane, and fruit (bananas, mango, tamarind, and guava). Agricultural environments contain fertile soils, relatively high rainfall rates, and sufficient water for cultivation (Central Annual Statistics, 2010).



Figure 1: The study area

**The study sample:** The study included all the 230 coffee farmers in study area listed with the Ministry of Agriculture and Irrigation. Data were collected from 200 farmers, representing some 86% of the total number of farmers after excluding 30 incomplete questionnaires.

**Data collection:** The Faculty at the Department of Agricultural Extension and Rural Society at the King Saud University (KSU) helped produce a simple to understand questionnaire. Before conducting the study,

the questionnaire was tested for its validity and reliability on 30 farmers who were not part of the study sample. The primary data were collected by using the study questionnaires during personal face-to-face interviews.

**Data analysis:** The data analysis process included reviewing and coding, and data tabulation processes. A number of statistical methods were employed by using SPSS 17 to analyze and describe the results. Frequency, percentages, arithmetic means, and standard deviations

were used to identify the personal, social, and economic characteristics of the respondents. Simple Pearson correlation coefficients were used to identify the nature of the correlation between variables and the coefficient of multiple regression (step-wise) was used to determine the degree of change in the dependent variable.

## RESULTS AND DISCUSSION

**Level of knowledge about agricultural operations possessed by coffee crop growers in Udeen:** In order to explore the agricultural knowledge possessed by the farmers, a survey was undertaken to determine what the agricultural operational knowledge levels were amongst coffee growers in Udeen. The results showed that the operational knowledge levels, expressed in degrees, ranged between 0 and 46 with a mean of 13.3 and a standard deviation of 12.2. The distribution of respondents according their level of knowledge is shown in Table 1. The study revealed that that 51% of the respondents' knowledge levels were low, 42.5% had an average level of knowledge, and 6.5% of respondents had a high level of knowledge. Therefore, 93.5% of the total respondents had knowledge levels that ranged between low and medium and this could be a possible cause of the decline in the coffee production in the study area and the lowered rank at the international level. Furthermore, these findings suggest that it is important that outreach programs be directed toward this group of farmers in

order to reduce their knowledge gap, which, in turn, will have a positive impact on the production of this crop. This will contribute directly or indirectly to increased farm incomes, improve the livelihoods of coffee growers, and elevate national income levels.

**Table 1. The distribution of farmers according to their levels of agricultural knowledge**

Knowledge Level	Number	Percentage %
Low (0 < 15)	102	5.0
Average (15–29.99)	85	42.5
High (> 30)	13	6.5
<b>Total</b>	<b>200</b>	<b>100</b>

**The agricultural knowledge level of farmers and its application to coffee crop production:** The answers from the respondents to each question about their knowledge level are shown in Table 2 in descending order, according to the arithmetic average for each question.

Table 2 confirms that overall, respondents have a generally low knowledge level. The study revealed that the arithmetic average used to measure the cognitive level ranges was 1.62 degrees for the questions concerning agricultural varieties that suit the region and 1.34 degrees for the types of pesticides used when storing the coffee beans.

**Table 2. The knowledge level of the farmers and its application to coffee crop production**

Agricultural knowledge	Knowledge Level			Average Arithmetic Mean
	High %	Average %	Weak %	
Agricultural varieties that suit the region	5	52	43	1.62
Appropriate distance between coffee trees	4.5	51.5	44	1.61
Types of fertilizer suitable for coffee trees	4.5	51.5	44	1.61
Appropriate timings to fertilize the coffee trees	4.5	50.5	45	1.61
Land tillage planning	4.5	51	44.5	1.60
Appropriate time for planting	4.5	51	45.5	1.59
Quality of soil suitable for coffee cultivation	4.5	50	44.5	1.59
Appropriate deadlines for irrigating coffee trees	4.5	49.5	44.5	1.59
Effects resulting from the lack of fertilizer	3.5	43.5	53	1.59
The amount of water required for coffee trees	3.5	43.5	53	1.51
Signs of excessive water application	3.5	42	54.5	1.49
Signs of lack of water	3.5	41.5	55	1.49
Effects produced by the excessive use of fertilizers	3.5	41	55.5	1.48
Pests of coffee trees	4.5	35	60.5	1.48
The best time to use the pesticides	3	34	63	1.44
Choosing the right time to harvest the coffee beans	3	32.5	64.5	1.39
Weeding dates for coffee trees	3	33.5	63.5	1.40
Types of pests that are resistant to pesticides	3	33	64	1.39
Diseases that affect coffee trees	3	32.5	64.5	1.39
Better drying, grading, and storing methods for coffee beans after harvest	3	33	64	1.39
Methods for packaging and marketing coffee beans	3	28.5	68.5	1.35
Types of pesticides that can be used when storing coffee beans	3	27.5	69.5	1.34

Table 2 emphasizes the urgent need to develop extension programs that focus on these subjects in order to raise the level of knowledge about improving the cultivation management and storage of the coffee crop, which will reflect positively on the quality of the crop and production levels. This, in turn, will contribute to improving the lives of working families in this area and increase Yemeni exports and national income.

**The degree to which agricultural technical operations that improve coffee crop production are implemented:**

The distribution of the respondents according to numeric

values that represent the degree to which they have applied new agricultural operations is presented in Table 3. The results showed that the levels of agricultural knowledge about new applications ranged between 0 and 46 degrees, with a mean of 14.4, and a standard deviation of 13.7.

The study revealed that about 49% of the respondents had low degree of knowledge about applying agricultural operations; 38.5% had an average degree of knowledge, and 12.5% of respondents had a high degree of knowledge about applying agricultural operations.

**Table 3. The distribution of the farmers according to the degree to which they applied agricultural operations**

Application degree	Number	Percentage
Low (0–14.99) degrees	98	49
Medium (15–30) degrees	77	38.5
High > 30 degrees	25	12.5
<b>Total</b>	<b>200</b>	<b>100</b>

Table 3 shows that 87.5% of the respondents were classified as between low and medium for application of new agricultural operations. This suggested that there was a low level of knowledge about applying agricultural operations, which could contribute to the low coffee crop production figures and reduce Yemen's position in the world rankings. The results suggest that there should be extension training programs for the farmers to create awareness, upgrade their skill levels, and help them overcome the reasons that are preventing them from applying better agricultural operations. There is a need to identify the reasons that are directly and indirectly causing a decline in the coffee crop productivity in terms of quantity and quality, which has led to Yemen losing international trade.

**Distribution according to how well farmers applied their knowledge to agricultural operations:** The degree to which farmers applied their knowledge to agricultural operations is listed in Table 4 and shows a low implementation by the respondents of new applications to agricultural operations. According to the average mean for each process, the arithmetic average range was 1.63 degrees for some agricultural operations, such as ground preparation and planning for agriculture, shading seedlings from the sun, and protecting seedlings from animals. The range was 1.34 degrees for the use of pesticides from their own stores. The results suggest that respondents' commitment to implementing some of these agricultural operations could adversely affect the production rates per unit area, which may have caused the decline in production levels in Yemen over the past years in terms of quantity and quality. This may have lowered Yemen's global rank, because the product was unable to compete with that of the other coffee producers with regard to the quality standard that the country had

achieved previously (IFAD, 2012). The results indicate the importance of role extension to help respondents overcome this shortcoming. They also suggest that extension programs need to be activated and pilot efforts should be intensified in this area.

**Relationship between independent variables and the degrees of knowledge and its application to agricultural operations when it is defined as the dependent variable:** To achieve the objective of the study, it was appropriate to study the correlation between degree of knowledge and the level to which it is applied to agricultural operations by the respondents and all the independent variables.

Table 5 shows that there was a positive and significant correlation at the P = 0.01 probability level between the levels of knowledge and its application, and educational qualification, land tenure, area cultivated with coffee, satisfaction with the extension service, and the degree of exposure to sources of information, in particular TV and radio. This means that these independent variables increase the respondents' knowledge and application levels. Baig and Aldosari (2013) highlighted the importance of Radio and TV and their role in disseminating the information for the farmers. However, they advised not to use radio as the medium to broadcast complex agricultural information.

There were negative correlations at the P = 0.01 level between the dependent variable and the age of the respondent and the type of tenure. This means that the older the respondent: the lower the degree of knowledge and its application level. This could be due to strong adherences to old, traditional knowledge because older farmers are less exposed to reliable sources of information. The negative affect of type of land ownership held by the respondent may be an indication of

a lack of full-time agricultural labor and a reliance on family labor, or that the leasing arrangements make new knowledge and applications less accessible.

**Table 4. The degree to which agricultural operations are applied in the study area**

Agricultural Operations	Degree of Application			Arithmetic Mean
	High %	Average %	Weak %	
Land operations and planning for cultivation	4.5	53.5	42.0	1.63
Shading seedlings from the sun and protection from animals	5.0	53.0	42.0	1.63
Hole dimensions when planting seedlings	5.5	52.0	42.5	1.63
Procedures in the nursery	4.0	54.5	41.5	1.63
Application of fertilizers to the coffee trees	5.0	54.5	41.5	1.63
Storing seeds	4.0	54.5	41.5	1.63
Seed treatments	4.5	53.0	42.5	1.62
Planting coffee trees in the soil	5.5	51.0	43.5	1.62
Making tubes for the coffee trees	4.5	53	42.5	1.62
Seed selection	4.5	54	42	1.62
Transfer of coffee trees	5	52	43	1.62
Maintenance and rebuilding of agricultural terraces	3.5	52.5	44	1.60
Maintenance of irrigation channels among the coffee trees	3.5	41	55.5	1.48
Coffee harvest stages	5	35.5	59.5	1.46
The use of irrigation networks between coffee trees	2.5	40	57.5	1.45
Coffee tree propagation operations	3	38	59.	1.44
Resistance to diseases	3	37.5	59.5	1.44
The use of pesticide spraying machines	3	37	60	1.43
Methods of mechanical control of pests in coffee storage rooms	3.5	36	60.5	1.43
Storing the crop after drying	3	36	61	1.42
Dealing with the crop after harvest in the best possible manner	3.5	33	63.5	1.40
Dealing with crop storage pests	3	32	63.5	1.38
Use of pesticides	3	28	59	1.34

**Table 5. The correlations between the personal economic and social characteristics of the farmers as independent variables**

Independent variables	Correlation coefficient	Level of coefficient
Age	-0.347	**
Number of family members	-0.070	--
Educational qualifications	0.196	**
Basic profession	-0.044	--
Total area of farm	0.232	**
Cultivated coffee area	0.186	**
Farm holding type	-0.237	**
Other agricultural activities	-0.008	--
Annual income of the coffee crop	0.065	--
Full-time farm work	0.026	--
Satisfaction with the extension services in the region	0.287	**
Degree of exposure to sources of agricultural information	0.470	**

\*\* significant at the P 0.01 level of probability.

The findings clearly suggested that factors such as a lack of knowledge and, therefore, its application to agricultural operations in the study area were responsible for a decline in production and farm incomes. Consequently, these declines have negatively affected the livelihoods at the family level and have reduced Yemeni national income. Currently, Yemeni coffee has a low quality rank because it is not certified and is unable to meet international standards and compete with global competitors.

**Based on the findings of the study, the following recommendations are made:**

1. The study established the role and need of agricultural extension for the farmers and training programs for the agricultural extension workers so that they can bridge the knowledge gaps among the coffee growers.
2. The study findings suggest that agricultural extension programs should be developed along with an action plan that identifies their objectives and addresses the low levels of knowledge highlighted by the research results. Agricultural Extension Department should prioritize its objectives based on the importance and urgency of the issues faced by the farmers.

3. Television and radio programs should be developed that could enhance the knowledge levels and technical skills of the farmers, particularly the coffee growers. The results suggest that these are the respondents' preferred sources of information and will be of most help raise awareness on the importance of this strategic crop.

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