The Influence of Labor and Cost of Production on Rice Production at Ahero Irrigation Scheme, Kenya

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Abstract

Rice production is done in over one hundred nations. Its harvested areas cover around 158 million hectares, with a milled rice production of over 700 million tons yearly. Asia produces almost 640 million tons and this represents 90% of the global rice production. (FAO 2014) In the developing world, rice has become the most demanded food crop and staple food to over half of the total population. In Kenya, rice is ranked the third most used staple food after wheat and maize. It is a cash crop to most of the small-scale farmers in the country. This study is focused to determine the influence of labor and cost on rice production in Ahero Irrigation Scheme. A descriptive cross-sectional study design was used in this survey. Surveys were used to collect quantitative data. The descriptive study ensured that the respondents' events, profiles, and situations were accurately captured. The target rice producers in Ahero irrigation scheme from which a sample of 285 respondents were randomly selected. The sample size calculation was arrived at using the Cochran and Snedecor (1989) formula, research applied a two-stage sampling procedure. The first stage involved a purposive selection of Ahero irrigation scheme paying attention to their importance on the number of farmers, the area under farming, and their geographical location. The collected data was then analysed using the Statistical Package for Social Sciences (SPSS) version 20 and STATA 14 where descriptive and cross tabulations were done. Logistic regression was also performed and the effects of the independent variables on rice production were determined. The results were presented in the form of tables and charts. The results show that from the total participants 182(63.86) were male while 103(36.14) were female. The majority of the participants were above 41 years 103(36.01). The regression analysis results inform that the rice farmers who used between Kenya shillings (Kshs) 1,000-3,000 buying the seeds were 5.76 times more likely to produce a high quantity of rice 162(68.35) as compared to the farmers who used below Kshs 1,000 on the seeds purchases with a p-value of 0.011 (COR=5.76, 95% CI=1.48-22.32). The findings reveal that the household with 11 and above occupants was 4 times likely to produce a high quantity of rice production as compared to those with 1-5 occupants with a significant p-value of 0.003 (COR=4, 95% CI=1.61-9.96). Rice production is affected by both cost and labor availability, in the study it is evident that high-quality seeds are costly and the farmers who afford them produce more rice than those who use less amount of money to buy their seeds. On the other hand, labor availability is a crucial factor in rice farming, the results have shown that the households with more than 11 occupants are a source of labor to their farms and their rice yields are high compared to the households with fewer occupants.

Keywords: Cost of Production, Irrigation Scheme, Labor.

INTRODUCTION

Rice is in the family *Poaceae* in the tribe *Oryzae* and genus *Oryza (*Szaresk *et al.*, 2019). The genus has over 22 species spread across Africa, Asia, Australia, and south and Central America. However, only two species are grown; *Oryza sativa* and *Oryza glaberrima*. *Oryza'*s two major subspecies are japonica and indica and were domesticated 12,000 years ago (Lachagariet al., 2019). Indica is more prevalent in tropical zones while japonica is prevalent in the temperate and subtropical regions in East Asia. *Oryza glaberrima* is Africa's indigenous rice species that was domesticated in West Africa's Niger in 3,500 BC. *Oryza sativa* was planted in Africa 2,000 years back during the flourishing of Indian and East African ports (Seck *et al.*, 2012).

Rice production is done in over one hundred nations. Its harvested areas cover around 158 million hectares, with a milled rice production of over 700 million tons yearly (Seck *et al.,* 2012). Asia produces almost 640 million tons and this represents 90% of the global rice production. Sub-Saharan Africa yields around 20 million tons while Latin America produces 25 million tons. Rice production in both sub-Saharan Africa and Asia is done on small scale farms of between 0.5 to 3 hectares (Hegde & Hegde, 2013). India and China are the world's largest rice producers, accounting for 30% of global rice production (Awika, 2011). Despite its dominance in Asia, rice is also considered a necessity in other parts of the world (Center, 2010). In Kenya, the approximate area for drainage and irrigation is around 6,000 hectares and 540,000 hectares respectively (Omondi, 2014).

In the developing world, rice has become the most demanded food crop and staple food to over half of the total population (Khush, 2013). Over 3.5 billion people worldwide consume rice at a rate of 20% of their daily calorie intake (Seck *et al.*, 2012). Its consumption has been high; surpassing 100kgs per capita yearly in quite a several Asian and African country (Gajigo & Denning, 2012). It is viewed as a convenient food in the expanding urban population. Its composition in terms of nutrients varies depending on soil characteristics, variety type, fertilizer types, and environmental conditions (Moe *et al.*, 2019). Rice is the third most widely consumed staple food in Kenya, after wheat and maize (Mwajita et al., 2013). It is a cash crop for the majority of the country's small-scale farmers. The four main irrigation schemes are Ahero Irrigation Scheme West Kano Irrigation Scheme, Bunyala Irrigation Scheme, and Mwea Irrigation Scheme (Muema, 2018). In the Ahero Irrigation Scheme, small scale farmers carry out the production. Farming is done in about one acre, which can only cater for a single-family as a subsistence crop and a cash crop (Apind *et al.,* 2015).

Technological advancements have led to a decline in the amount of labor required in agricultural production from 1990 to 2016 (Yu *et al.*, 2018). In the developing nations, the second half of the 20th century has witnessed the introduction of mechanization, high yield variety (HYV), and continuous use of other farm inputs for irrigation and fertilizer application. The outcomes of these labor-saving operations have caused concern ever since mechanization began. Rice production in Asia and across other parts has experienced technological change (Uphoff, 2017).

Production of rice in India has intensified the use of HYV seeds, chemical fertilizers, and irrigation enhancement. This has resulted in a rise in rice production and input change phenomena. There is also agricultural operations mechanization, particularly in rice production. Rice remains the largest crop grown in India (Kumar et al., 2008). It is assumed to be a labor-intensive crop. Due to its mechanization process, rice cultivation labor intensity has reduced. The high population increases the labor force but the absorption of such labor has been challenging hence a policy concern. Subsistence rice production has been absorbing the labor force even though its marginal productivity has been lowKang et al. (2017) outlined a systematic approach to ensuring food security for the growing population. Transitioning from extensive cultivation to intense cultivation includes raising labor inputs, multiple cropping, irrigation, and technology, among others. Labor increases with an increase in agricultural output (Duvvuru & Motkuri, 2013).

In Nigeria, Rice is the main staple food (Ayoola et al., 2011), agricultural intervention is in place to elevate poverty and increase food security, and these interventions have not yet been achieved as compared to similar interventions in developed nations. The National Special Programs on Food Security (NSPFS) and the Presidential Initiative on rice, is focused to achieve food adequacy of rice production locally in short term as well as increase exports in the medium-term targeting rice cultivation on 3 million hectares and 15 million tons of paddy rice or 9 million metric tons of milled rice (Ukpe, 2016).

Despite these efforts that have been put in place rice production in Nigeria is still very low and hence relying heavily on imports to feed its population. Studies have shown that women play important roles in food production, processing, and marketing in Nigeria. Women contribute close to 60-80 percent of food production in the country and are the main source of the agricultural labor force (Adebayo & Ojo, 2012).

(Ayoola et al. (2011) states that although women put more efforts into the immense role they play in Agriculture, they still can't access adequate productive resources such as land, farm inputs, sensitization on how to carry out farming activities, and modern technology hence gender is a crucial element in the development process to strengthen equality and enhance access of female and male farmers to increase on the labor that is necessary to improve on the production level. Another study conducted in Nigeria by Ohen & Ajah (2015) examined constraints on rice productivity and discovered that farmers' lack of access to finance and the high cost of seeds resulted in reduced yields. According to Fani et al. (2020), increasing labor costs in rice farming also increases production costs. Most of the efforts put in place to increase food supply as well as earning income are aimed at increasing production on the farms. A descriptive cross-sectional study performed by qualitative focus group discussions was done in two major rice-producing districts in Eastern Uganda to determine how the workforce helps in reducing the postharvest losses. Families who lack men to provide labor on their farms are forced to hire laborers to work on their farms. This has led to farmers having poor production on the farms due to delayed and lack of workforce to provide labor on their farms, in the cases where the farmers have hired labor lack of supervision results in postharvest losses (Lusiba *et al.*, 2017). According to a survey conducted by Bagamba et al. (2007), families provide labor on their farms when they are unable to hire laborers to increase rice productivity.

Research conducted to investigate the impact of rice blast on the livelihood of the farmers in the Mwea irrigation scheme indicated that the cost of rice production was very high since the chemicals and the methods that were used to control the diseases were too expensive and required a lot of hired labor to help in the control of the disease which was considered unaffordable to some farmers (Kihoro *et al.*, 2013). A survey done in Ahero Irrigation Scheme by (Omondi & Shikuku, 2013) has shown that increased farm inputs such as fertilizers and labor in rice farming lead to increased productivity, however, chemical and seeds costs reduce the productivity of rice. The researcher suggested that policies should focus on cutting down the costs of farm inputs for the farmers to be able to afford them and increase their production levels.

METHODOLOGY

The research was done in Ahero Irrigation Scheme in Muhoroni Sub-County, Kisumu County, Kenya. The county's black cotton soil is very fertile but its drainage is poor but ideal for rice production. Almost all the irrigated land is used for rice production. The irrigation scheme is run by the National Irrigation Board which also partners with farmers. The current area under rice farming is over 2000 acres that have been split into 12 blocks. The total number of farmers is 1650 (National Irrigation Board). Rice is the main crop in the irrigation scheme. The main varieties grown are ITA 310 and IR 2793-80-1. There are other crops grown such as tomatoes and maize for subsistence. Farm inputs like seeds, fertilizers, and other chemicals are issued by the Board. Farmers are also allowed to buy farm inputs from other suppliers and they can access funds from the scheme and the farmers' organization. The Regions terrain is Plain and thus characterized by flat surface and water for irrigation is pumped from the river Nyando, which flows to Lake Victoria. A descriptive cross-sectional study design was used. Surveys were used to collect quantitative data. The descriptive study ensured that the respondents' events, profiles, and situations were accurately captured. The rice producers in Ahero Irrigation Scheme were the target respondents. The target population was 2168 rice producers. The research applied a two-stage sampling procedure. The first stage involved a purposive selection of Ahero irrigation scheme paying attention to their importance on the number of farmers, the area under farming, and their geographical location. The scheme is accessible geographically, thus allowing information and technology to flow freely from either the farmers or researchers. This provides good information on how farmers operate in the scheme. A sample of 285 rice producers was randomly chosen using a sampling frame of a list from the Ahero irrigation scheme. The sample size calculation was done using the Cochran and Snedecor (1989) formula $\frac{Z^2pq}{e^2}$.

The survey aimed at collecting responses from as many people as possible. As this is impossible, the sample size calculation helped to establish the smallest number of individuals who should be interviewed. Hence, the sample size was settled to be 285 rice farmers. The validity of study instruments was done to ensure that the results were useful scientifically. To ensure validity, questionnaires were developed, pretested, rectified, and administered to the respondents. This ensured that all ambiguous, vague, and unclear questions were corrected and the needed adjustments were done. The study utilized both secondary and primary data. Primary data was obtained using structured questionnaires. The questionnaire included the household size, age of the household head, extension facilities, education level, and the quantity of input and output used in the production. Data were obtained from the sampled households. The collected data was then entered into the Statistical Package for Social Sciences (SPSS) version 20. Data management was done and any outliers were removed. The data was then exported to Stata 14 where descriptive statistics and cross-tabulation was done. Logistic regression was also performed and the effects of the independent variables on rice production were determined.

RESULTS

This section presents the findings of the survey. It describes the demographic characteristics of the study participants from the Ahero irrigation scheme, the total rice production inferential statistics of the data.

The demographic characteristics of the study participants

The tabel below shows the demographic characteristics of the respondents in the study.

Table 1: demographic characteristics of the respondents

Variables	N	%
Gender		
Male	182	63.86
Female	103	36.14
Age brackets in years		
20 years and below	44	15.38
21 to 30	66	23.08
31 to 40	73	25.52
41 and above	103	36.01
Level of education		
primary level	127	44.56
attended any school	3	1.05
secondary level	120	42.11
college level	22	7.72
university level	13	4.56
Marital Status		
Single	59	20.63
married	209	73.08
widowed	18	6.29

The results show that from the total participants 182(63.86) were male while 103(36.14) were female. 44(15.38) of the participants were below 20 years while the majority of the participants were above 41 years 103(36.01). The majority of the respondents attained primary education level 127(44.56) followed by those who attained secondary education level 120(42.11), those who attended any school were the least 3(1.05). Close to three-quarters of the participants were married 209(73.08) and a few of them were widowed 18(6.29) and the rest of them were single 59(20.63).

Number of bags of rices produced per acre

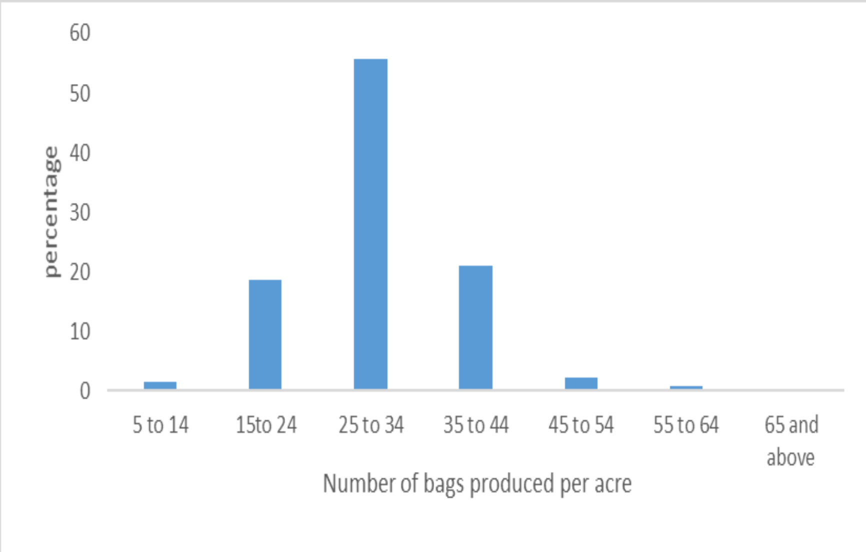

Figure 1: The bar graph showing the number of bags of rice per acre

From the results, it is evident that the majority of farmers were producing a high quantity of rice comprising of 66.43% whereas a few of the farmers got low production accounting to 33.57%.

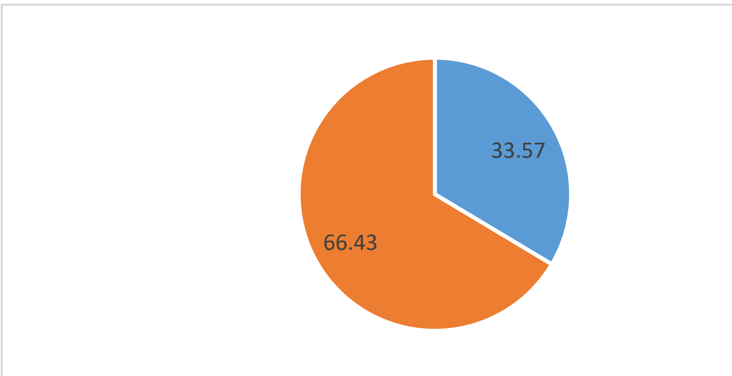

Figure 2: A pie chart showing the percentage of rice production

The majority of the respondents 55.8% produced 25 to 34 bags of rice per acre followed by respondents who produce 35 to 44 bags per acre and the least bag produced by farmerswere bags and above (0.4) of rice per acre.

The influence of labor and costs of production on rice production in Ahero irrigation scheme

The table below shows the data on the influence of labor and costs of production on rice production in Ahero irrigation scheme.

Table 2: The influence of costs of production on rice production in Ahero irrigation scheme

		Crop Production				
	Overall	Low production	High Production			
Cost (Kshs)	**N (%)**	**N (%)**	**N (%)**	**COR**	**95% CI**	**p value**
Cost of seeds						
below 1000	11(3.85)	8 (72.73)	3 (27.27)	Ref		
1000 to 3000	237(82.87)	75 (31.65)	162 (68.35)	5.76	1.48-22.32	**0.011**
3001 to 6000	36(12.59)	12 (33.33)	24 (66.67)	5.33	1.19- 23.8	**0.028**
above 6000	2(0.7)	1(50.00)	1(50.00)	2.67	0..12-57.6	0.532
Cost land preparation						
below 1000	5(1.75)	4 (80.00)	1 (20.00)	Ref		
1000 to 3000	72(25.17)	20 (27.78)	52 (72.22)	10.4	1.09- 98.8	**0.041**
3001 to 6000	108(37.76)	44 (40.74)	64 (59.26)	5.82	0. .63-53.8	0.121
above 6000	101(35.31)	28 (27.72)	73 (72.28)	10.4	1.12- 97.4	**0.040**
Cost planting						
Below 1000	2(0.7)	0 (0.00)	2(100.00)	Ref		
1000 to 3000	178(62.24)	52 (29.21)	126 (70.79)	1.60	0.96-2.66	0.070
3001 to 6000	103(36.01)	41(39.81)	62 (60.19)	1		
6001 and above	3(1.05)	3 (100.00)	0 (0.00)	1		
Cost of weeding						
below 1000	7(2.45)	5 (71.43)	2 (28.57)	Ref		
1000 to 3000	81(28.32)	28 (34.57)	53 (65.43)	4.73	0.86- 25.9	0.074
3001 to 6000	172(60.14)	55 (31.98)	117 (68.02)	5.31	1.00-28.2	0.050
above 6000	26(9.09)	8 (30.77)	18 (69.23)	5.62	0.89- 35.3	0.066
Cost of fertilizer						
below 1000	4(1.40)	3 (75.00)	1 (25.00)	Ref		
1000 to 3000	50(17.48)	15 (30.00)	35 (70.00)	6.99	0.67-72.9	0.104
3001 to 6000	88 (30.77)	25 (28.41)	63 (71.59)	7.56	0.75-76.2	0.086
above 6000	144(50.35)	53 (36.81)	91 (63.19)	5.15	0.52-50.8	0.160
Operation cost						
below 1000	21(7.34)	12 (57.14)	9 (42.86)	Ref		
1000 to 3000	58(20.28)	15 (25.86)	43 (74.14)	3.82	1.34-10.9	**0.012**
3001 to 6000	177(61.89)	55 (31.07)	122 (68.93)	2.96	1.18- 7.43	**0.021**
above 6000	30(10.49)	14 (46.67)	16 (53.33)	1.52	0.49-4.68	0.462

The findings of the regression analysis show that the farmers who used between *Kenya shillings (Kshs)* 1,000-3,000 buying the seeds were 5.76 times more likely to produce a high quantity of rice compared to the farmers who used below Kshs 1,000 with a significant p-value of 0.011 (COR=5.76, 95% CI=1.48-22.32), again farmers whose cost of seeds was between Kshs 3,001- 6,000 were 5.33 more likely to have high rice production compared to those whose cost was below Kshs 1,000 with a p-value of 0.028. (COR=5.33, 95% CI=1.19-23.8). On the cost of land preparation, farmers whose cost was above Kshs 6,000 were 10.4 times more likely to produce a higher quantity of rice compared to the farmers whose cost was below Kshs 1,000 with a p-value of 0.040(COR=10.4, 95% CI=1.12- 97.4).and the farmers whose land preparation cost was between Kshs 1,000 to 3,000 had 10.4 more likely to produce more rice than those whose land preparation cost was below Kshs 1,000 with a significant p-value of 0.021 (COR=2.96, 95% CI=1.18- 7.43).

Farmers who spent Kshs 1,000 to 3,000 on operation cost of rice production were 3.82 times more likely to have high production compared to those who spent below Kshs 1,000 at p value=0.012 (COR=3.82, 95% CI=1.34-10.9) and the farmers who spent between Kshs 3,001 to 6,000 on operation had a 2.96 likely chance to getting more rice yields as compared to those whose operating costs were below Kshs 10

Table 3: Multivariate analysis of the influence of cost on rice production in Ahero irrigation scheme

		Crop Production					
	Overall	**Low production**	**High Production**				
Cost (Kshs)	**N (%)**	**N (%)**	**N (%)**	**COR(95% CI)**	**p value**	**AOR(95% CI)**	**p value**
Cost of seeds							
below 1000	11(3.85)	8 (72.73)	3 (27.27)	Ref		Ref	
1000 to 3000	237(82.87)	75 (31.65)	162 (68.35)	5.76(1.48-22.32)	**0.011**	13.55(2.25-81.64)	**0.004**
3001 to 6000	36(12.59)	12 (33.33)	24 (66.67)	5.33(1.19- 23.8)	**0.028**	9.7(1.25-75.31)	**0.03**
above 6000	2(0.7)	1(50.00)	1(50.00)	2.67(0.12-57.6)	0.532	9.69(0.24-383.18)	0.226
Cost land preparation							
below 1000	5(1.75)	4 (80.00)	1 (20.00)	Ref	Ref		
1000 to 3000	72(25.17)	20 (27.78)	52 (72.22)	10.4(1.09- 98.8)	**0.041**	7.18(0.53-97.48)	0.139
3001 to 6000	108(37.76)	44 (40.74)	64 (59.26)	5.82(0.63-53.8)	0.121	4.22(0.33-53.61)	0.267
above 6000	101(35.31)	28 (27.72)	73 (72.28)	10.4(1.12- 97.4)	**0.04**	11.37(0.9-144.35)	0.061
Cost planting							
Below 1000	2(0.7)	0 (0.00)	2(100.00)	Ref			
1000 to 3000	178(62.24)	52 (29.21)	126 (70.79)	1.6(0.96-2.66)	0.07	2.22(1.08-4.58)	**0.031**
3001 to 6000	103(36.01)	41(39.81)	62 (60.19)	1			
6001 and above	3(1.05)	3 (100.00)	0 (0.00)	1			
Cost of weeding							
below 1000	7(2.45)	5 (71.43)	2 (28.57)	Ref			
1000 to 3000	81(28.32)	28 (34.57)	53 (65.43)	4.73(0.86- 25.9)	0.074	15.69(1.19-206.33)	**0.036**
3001 to 6000	172(60.14)	55 (31.98)	117 (68.02)	5.31(1.00-28.2)	0.05	13.48(1.18-154.62)	**0.037**

above 6000	26(9.09)	8 (30.77)	18 (69.23)	5.62(0.89- 35.3)	0.066	37.69(2.57-553.23)	**0.008**
Cost of fertilizer							
below 1000	4(1.40)	3 (75.00)	1 (25.00)	Ref			
1000 to 3000	50(17.48)	15 (30.00)	35 (70.00)	6.99(0.67-72.9)	0.104	9.78(0.74-129.27)	0.083
3001 to 6000	88 (30.77)	25 (28.41)	63 (71.59)	7.56(0.75-76.2)	0.086	18.45(1.47-231.24)	**0.024**
above 6000	144(50.35)	53 (36.81)	91 (63.19)	5.15(0.52-50.8)	0.16	18.21(1.49-221.99)	**0.023**
Operation cost							
below 1000	21(7.34)	12 (57.14)	9 (42.86)	Ref			
1000 to 3000	58(20.28)	15 (25.86)	43 (74.14)	3.82(1.34-10.9)	**0.012**	4.99(1.09-22.87)	**0.038**
3001 to 6000	177(61.89)	55 (31.07)	122 (68.93)	2.96(1.18- 7.43)	**0.021**	2.35(0.67-8.18)	0.181
above 6000	30(10.49)	14 (46.67)	16 (53.33)	1.52(0.49-4.68)	0.462	1.31(0.3-5.79)	0.723

Regarding the cost of production, respondents that purchased seeds of between Kshs 1,000 to 3,000 had 13.55 likelihood to having high production of rice with a significant p value of 0.004(AOR=13.55, 95% CI= 2.25-81.64) and those whose cost of seeds was between Kshs 3,001 to 6,000 had 9.7 likelihood of getting high production with significant p value of 0.03 (AOR=9.7, 95% CI= 1.25-75.31) compared to respondents whose cost of seeds was below Kshs 1,000.

In addition, where the planting cost was 1000 to 3000, there was 2.22 likelihood of producing more rice with a p value of 0.031(AOR=2.22, 95% CI= 1.08-4.58) compared to where the planting cost was below Kshs 1,000.

For the cost of weeding respondents whose cost of weeding was 1000 to 3000 there was 15.69 likelihood of high production with a significant p value of 0.036 (AOR=15.69, 95% CI= 1.19-206.33) compared to respondents with cost of weeding less than Kshs 1,000. The cost of weeding that was between Kshs 3,001 to 6,000 had 13.48 chances of producing more rice with significant value of 0.37 (AOR=13.48, 95% CI= 1.18-154.62) compared to where the cost of weeding was below Kshs 1,000. Respondents using above Kshs 6,000 in weeding have 37.69 chances of getting high production with a statistically significant value of 0.008 (AOR=37.69, 95% CI= 2.57-553.23) compared to respondents whose cost of weeding was below Kshs 1,000. Farmers who used fertilizers costing 3001 to 6000 were 18.45 more likely to produce high yields of rice with a significant value of 0.024 (AOR=18.45, 95% CI= 1.47-231.24) and 18.21 likelihood for high yields for the farmers who used above Kshs 6,000 to purchase fertilizers with a p value of 0.023 (AOR=18.21, 95% CI= 1.49-221.99) compared to farmers who used below Kshs 1,000 in fertilizers. Finally, respondents with operation costs between Ksh1,000 to 3,000 s were 4.99 more likely to get high rice yields with a significant p value=0.038 (AOR=4.99, 95% CI= 1.09-22.87) compared to the respondents whose operation cost was below Kshs 1,000.

The influence of availability of labor on rice production in Ahero irrigation scheme

The table below shows the influence of availability of labor on rice production in Ahero irrigation scheme. The regression analysis results show that the household with 11 and above occupants was 4 times likely to produce a high quantity of rice production as compared to those with 1-5 occupants with a significant p-value of 0.003 (COR=4, 95% CI=1.61-9.96). On the other hand, the household with between 6-10 occupants were 2.15 highly expected to produce more rice than the households with 1 to 5 occupants.

From the results table 4, there is an indication that there was a 2.85 times expectation of getting high rice yields where school-going children were aged between 9 to 18 years worked 5 to 9 days compared to when they worked for 0 to 4 days at a significant p value=0.004 (COR=2.85, 95% CI=1.40-5.79). Moreover, children who worked between 10 to 14 days were 2.35times likely to produce high yields compared to where they worked 0 to 4 days with a statistically significant p-value of 0.038 (COR=2.35, 95% CI=1.05-5.25). lastly, children working for 15 days and above were 2.97 times more likely to produce a high quantity of rice compared to where they worked for 0 to 4 days with a significant p-value of 0.006 (COR=2.97, 95% CI=1.37-6.39).

Table 4: The influence of availability of labor on rice production in Ahero irrigation scheme

		Crop Production				
	Overall	Low production	High Production			
Variables	N (%)	n (%)	n (%)	COR	95% CI	p value
Size of household						
1 to 5	65(22.72)	32(49.23)	33 (50.77)	Ref		
6 to 10	180(62.94)	56 (31.11)	124 (68.89)	2.15	1.20-3.83	**0.010**
11 and above	41(14.34)	8 (19.51)	33(80.49)	4	1.61-9.96	**0.003**
Head of the family						
Father	236(82.5))	73 (30.93)	163(69.07)	Ref		
Mother	49(16.4)	22 (44.90)	27 (55.10)	0.55	0.29-1.03	0.061
Child	1(0.34)	1 (100.00)	0 (0.00)			
Household >18						
0 to 4	185(64.7)	70 (37.84)	115 (62.16)	Ref		
5 to 9	38(13.3)	13 (34.21)	25 (65.79)	1.17	0.56-2.44	0.674
10 to 14	19(6.6)	3 (15.79)	16 (84.21)	3.25	0.91-11.5	0.069
15 and above	44(15.4)	10 (22.73)	34 (77.27)	2.07	0.96-4.44	0.062
School going children 9-18 yrs.						
0 to 4	50 (17.5)	27 (54.00)	23 (46.00)	Ref		
5 to 9	96 (33.7)	28 (29.17)	68 (70.83)	2.85	1.40-5.79	**0.004**
10 to 14	51(17.8)	17 (33.33)	34 (66.67)	2.35	1.05-5.25	**0.038**
15 and above	67(23.4)	19 (28.36)	48 (71.64)	2.97	1.37-6.39	**0.006**
Small children less than 9 yrs.						
0 to 4	232(81.1)	80 (34.48)	152 (65.52)	Ref		
5 to 9	6(2.51)	2 (33.33)	4 (66.67)	1.05	0.18-5.87	0.953
15 and above	1(0.42)	0 (0.00)	1 (100)			

Multivariate analysis of the influence of cost on rice production in Ahero irrigation scheme

Table 5: Multivariate analysis of the influence of cost on rice production in Ahero irrigation scheme

		Crop Production					
	Overall	**Low production**	**High Production**				
Variables	**N (%)**	**n (%)**	**n (%)**	**COR(95% CI)**	**p value**	**AOR(95% CI)**	**p value**
Size of household							
1 to 5	65(22.72)	32(49.23)	33 (50.77)	Ref		Ref	
6 to 10	180(62.94)	56 (31.11)	124 (68.89)	2.15(1.20-3.83)	**0.01**	2.31(0.89-5.96)	0.084
11 and above	41(14.34)	8 (19.51)	33(80.49)	4(1.61-9.96)	**0.003**	3.14(0.84-11.79)	0.09
Head of the family							
Father	236(82.5))	73 (30.93)	163(69.07)	Ref		Ref	
Mother	49(16.4)	22 (44.90)	27 (55.10)	0.55(0.29-1.03)	0.061	0.54(0.22-1.34)	0.184
Child	1(0.34)	1 (100.00)	0 (0.00)				
Household >18							
0 to 4	185(64.7)	70 (37.84)	115 (62.16)	Ref		Ref	
5 to 9	38(13.3)	13 (34.21)	25 (65.79)	1.17(0.56-2.44)	0.674	0.68(0.19-2.45)	0.561
10 to 14	19(6.6)	3 (15.79)	16 (84.21)	3.25(0.91-11.5)	0.069		
15 and above	44(15.4)	10 (22.73)	34 (77.27)	2.07(0.96-4.44)	0.062	1.71(0.58-5.06)	0.333

School going children 9-18 yrs.							
0 to 4	50 (17.5)	27 (54.00)	23 (46.00)	Ref		Ref	
5 to 9	96 (33.7)	28 (29.17)	68 (70.83)	2.85(1.40-5.79)	**0.004**	3.22(1.04-9.98)	**0.043**
10 to 14	51(17.8)	17 (33.33)	34 (66.67)	2.35(1.05-5.25)	**0.038**	2.79(0.81-9.57)	0.103
15 and above	67(23.4)	19 (28.36)	48 (71.64)	2.97(1.37-6.39)	**0.006**	3.39(0.91-12.56)	0.068
Small children less than 9 yrs.							
0 to 4	232(81.1)	80 (34.48)	15(65.52)	Ref		Ref	
5 to 9	6(2.51)	2 (33.33)	4 (66.67)	1.05(0.18-5.87)	0.953	1.18(0.13-10.44)	0.88
15 and above	1(0.42)	0 (0.00)	1 (100)				

The table 5 above shows the Multivariate analysis of the influence of cost on rice production in Ahero irrigation scheme. The findings shows that families with 5 to 9 school going children 9-18 years are 3.22 more likely to have more rice produce with a significant p value of 0.043 (AOR=3.22, 95% CI= 1.04-9.98) compared to families with 0 to 4 school going children who are 9- 18 years.

DISCUSSION

Adoption of farm inputs like the HYV seeds influences rice production (Rasyid *et al.*, 2016). An increase in the number of seeds leads to an increase in the number of rice crops hence raising the production (Arifin & Nirawal, 2018). The study revealed that the majority of farmers who spent more cash on seeds had the likelihood of harvesting more rice than those who spent lesser cash. The costs of seeds were associated with quality. The higher the cost seeds were of better quality.

Machinery use has a positive impact on the quality of rice produced. According to Kabora (2016), the use of animal fraction contributed to a 5% increase in the quality of rice produced. This is in line with our findings where rice farmers who spent more cash to prepare their land for farming were 10.4 times more likely to have more yields as compared to those who spent less to prepare their farms. Rice production has been increasing then its demand. The study also established that farmers who spent more (Kshs 1,000 to 3,000) on-farm operation costs were almost 4 times more likely to have high production than those who spent less than Kshs 1,000.

Production is affected by labor. A large household is likely to have a positive impact on the family's farm produce as all family members contribute to carrying out farm operations (Rasyid *et al.*, 2016). In the Ahero irrigation scheme, the presence of labor depended on the number of people in the household. The households having around 6 to 10 individuals were 2.15 times more likely to have high rice crop yield but those who had over 10 occupants were 4 times likely to get higher yields.

Added labor makes it easy when weeding, tilling, soiling applying fertilizers, and when controlling pests and diseases. When all these are implemented well, they increase rice production (Rasyid *et al.*, 2016). The findings of this research were in line with the findings of Takahashi & Barrett, (2014). as they revealed a significant likelihood of getting more rice yield where older children of 18 years to 9 years worked for more days. This established that the addition of labor increases the production of rice hence increasing the income of farmers.

CONCLUSION

Rice production is affected by both cost and labor availability, in the study it is evident that high-quality seeds are costly and the farmers who afford them produce more rice than those who use less amount of money to buy their seeds. On the other hand, labor availability is a crucial factor in rice farming, the results have shown that the households with more than 11 occupants are a source of labor to their farms and their rice yields are high compared to the households with fewer occupants.

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