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Drivers of Crop Distribution and Duration Diversification among Small holder Farmers in Kenya

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Abstract: Agriculture is the most important sector in the Kenya. Crop farming in Mathira East District is characterized by different forms of diversification. However, there is little knowledge on specific drivers of diversification. The main objective of this study was to determine the drivers of distributive and duration-based diversification. The mean-variance (E-V) approach and random utility theories were used to guide the study. Data was collected from150 smallholder farmers using a structured questionnaire. A Tobit regression model was used to identify the determinants of duration and distribution diversification. This study arrived at the finding that smallholder crop farming in the study area is characterized by distribution and duration-based diversification. Crop production risk, level of education, household average income per month and farm size were found to be important factors that influence farmers' decision to diversify in crop production with respect to their distribution. On the other hand, the variables relating to production risk, level of education and household average income per month were found to be important factors that influence farmers' decision to diversify in crop production with respect to the duration of cropping seasons. This study recommends that the government should endeavour to enlighten more farmers about the reality of production risks that may affect their crop production activities. The government should provide a conducive environment for farmers to improve their levels of education and household average income per month since these factors may help to boost diversified agriculture that lead to improved standard of living.
Keywords: Agriculture, endeavour, Tobit regression model

INTRODUCTION

A number of research studies have successfully identified the potential of diversification to contribute to better performance in agriculture by smallholder farmers in Kenya. Additionally, due to limited availability of high potential land, it has been envisaged that increasing agricultural production will have to come from diversification [1]. Promoting and supporting diversification opportunities is an integral part of most agricultural strategies in Kenya. The Government of Kenya, in collaboration with development partners, has over the years developed policies and strategies to enhance agricultural growth and improve household incomes through diversification.

In 2008, Kenya launched Vision 2030 as the country's long-term economic blueprint to guide the development process. Vision 2030's objective is to transform Kenya into a middle income country providing a high quality of life to all its citizens by 2030. Based on Vision 2030, the agricultural sector has developed the Agricultural Sector Development Strategy (ASDS) that envisages a food-secure and prosperous nation. The overall objective of the ASDS is to achieve an agricultural growth rate of 7 per cent per year over the next 5 years through various means, among them being promotion and support of diversification opportunities [2].

Mathira East District has a variety of crops grown, ranging from food to cash crops. These crops have varying durations of maturity. The most important food crops grown in the district include maize, beans, peas, potatoes, sweet potatoes, sorghum, millet and barley. Distributive diversification (balance between crops) and crops duration diversification (spread/balance in expected crop durations) are very common.

A broad range of economic and non-economic related factors influence the decisions to diversify [3]. However, in Mathira, the factors leading farmers to engage in different forms of diversification is not clear. Although farmers in Mathira have adopted diversified crop strategies, the choice may not be guided by economic but other considerations.

METHODOLOGY

The study area, the Mathira East District, is in Nyeri County where many farmers are diversified. Due to intense land subdivision, distribution and duration based crop diversification are farming strategies commonly practiced in the area. It has an area of about 129 Square Kilometres [4]. The district mainly has red

volcanic soils suitable for food crops such as maize, beans, peas, sorghum and potatoes.

A systematic random sampling technique was used to select the respondents. The target population was the smallholder crop farmers in the district. A total of 150 smallholder crop farmers were sampled for the study. The main data collection instrument was a household questionnaire directed at households' heads. The study further used secondary data where necessary while reviewing the literature and discussing results.

Analytical Framework: Tobit regression model

On-farm crop diversification was examined in terms of distribution (balance among different crops) and cropping durations (number of months taken for a crop to mature). The method used to measure crop distribution and duration based diversification was a modification of the Entropy index that lies strictly between zero and one. The entropy index is shown in Table 1.

Table-1: The Entropy Index Computation

Measure	Formula	Explanation
Entropy index	$\sum(P_i).[\log (1/P_i)]$	This index is a weighted sum of proportions [weights being log $(1/P_i)$]. It attains 0 with complete specialization and log (N) with perfect diversification. This is good for capturing the 'diversity' aspect of diversification as N varies, Thus, it shows how diversified is a distribution.

The entropy diversity index was censored because some of its values clustered at the limit (0 for complete specialization and 1 for perfect diversification). Standard ordinary least squares (OLS) or seemingly unrelated regression (SUR) of the diversity index would have yielded biased and inconsistent estimates in this situation and it was not appropriate to use them.

Censored regression model was employed to ascertain the determinants of on-farm crop diversification among smallholder crop farming households. Censored model assumes that all zeros are attributable to standard corner solutions. As such, zero observations are accounted for and the censored regression provides a more accurate estimation [5]. The model was used to analyze covariates of on-farm crop diversification and its intensity.

In censored regression models, the dependent variable is observed only if it is above or below some cut off level. The Tobit model is a special case of censored regression models that arise when the dependent variable is limited (or censored) from above and/or below. It is a non-linear model which employs maximum likelihood estimation technique to estimate the likelihood of a diversification strategy and its intensity. This model is appropriate since the dependent variable is an index which takes values between 0 and 1 inclusive. The dependent variable of the model can be either left-censored, right-censored, or both left-censored and right-censored, where the lower and/or upper limit of the dependent variable can be any number.

The two-limit Tobit model can be specified as:

$$y^*_i \quad X_i \quad {}_i \text{ ---------- } (4)$$

Where yi^* is a latent variable (unobserved for values smaller than 0 and greater than 1) representing specialization or diversification index; x_i is a vector of explanatory variables; β' is a vector of unknown parameters; and $\varepsilon_i$is a disturbance term.Denoting yi (diversification index) as the observed dependent variable the two limit Tobit model can be specified as:

$$yi = \begin{cases} 0 \ if \ y_i^* \leq 0 \\ y^* \ if \ 0 < y_i^* < 1 \\ 1 \ if \ yi > 1 \end{cases} \text{ ---------- } (5)$$

In principle, a maximum likelihood approach may be employed to address the censoring (Tobit model) and account for correlations in error terms across equations by specifying a multivariate density function for the error terms **[6]**. Censored regression models (including the standard Tobit model) are usually estimated by the Maximum Likelihood (ML) method. The log likelihood function is specified with an assumption that the disturbance term ε follows a normal distribution with mean 0 and variance σ2.

Table-2: Description of the Variables Used in the Tobit Model

Variable	Description	Expected sign
DISDIVER	Extent of distribution-based diversification practiced (the measure ranges from 0 and log (N))	---
DURDIVER	Extent of duration-based diversification practiced (the measure ranges from 0 and log (N))	----
RISK	Production risk (Measured as an index that range between 0 and 1)	+
GENDER	Gender of head of household (value 1 if male; 0 if female)	+/-
MARITAL	Marital status of the household head (value 1 if married; 0 if otherwise)	+
HHAGE	Age of head of household in years	+
EDUC	Highest level of education of the household head (measured in number of years of formal education)	+
INCOMEPM	Household income realized per month (in Kshs.)	+
LANDSIZE	Total size of land (value measured in acres)	+
HHSIZE	Household size	+
EXPER	Crop farming experience (in years)	

RESULTS AND DISCUSSION

The farmer characteristics are presented in Table 3. The study established that the majority (72%) of the respondents were male as compared to 28% who were female. This implies that most farming related decisions such as what to grow and how to grow the chosen crops is dominated by male.

In terms of education, most of the household heads had less than tertiary level of education. Majority (38.7%) of the respondents had primary level of education, 33.3% had secondary level of education while 18.7% had no formal education. It was only 6.7% and 2.7% of the household heads that had tertiary and university level of education respectively. This implies that majority of the crop farmers may lack adequate technical education which is a prerequisite to better modern crop farming.

The sampled household heads were of varying age brackets. About 40.7% of household heads were between the ages of 46 and 55 while 22.0% were between the ages of 56 and 65. About 19.3% and 12.7% of the household heads, respectively, fell into the age categories of 36-45 years, and above 65 years.

There were very few household heads that were young in age and as a result, only 5.3% of the total household heads were aged between 26 – 35 years and none of them was aged below 26 years. Age of the household head has an implication on the choice of farming strategies and consequently, the type of crops grown. This may be attributed to the preference of the older farmers for less labour intensive crops such as most staple crops (maize, beans, potatoes) while young farmers may comfortably grow crops that require more labour inputs such as most horticultural crops (tomatoes, cabbages, sukumawiki, French beans).

Majority (76.7%) of the households were headed by individuals who were married. The other categories of marital status were single (14.0%), widowed (4.0%), separated (3.3%) and divorced (2.0%). This implies that it is expected that in majority of the households have decision making responsibilities shared between male and female household heads.

About 32.7%, 62.0% and 5.3% of the respondents had household size of 1-5 persons, 6 -10 persons and 11 persons and above respectively. The mean household size stood at approximately 6 members, composed as 4 adults and 2 children (members aged below 13 years). The survey results are not significantly different from the average household size of 6 reported by the Kenya National Bureau of Statistics [7]. Household size can give an indication of the extent of pressure that could be exerted on the household resources. On the other hand it can also be an indication of the available family labour [8].

About 11.3%, 28.7%, 37.3% and 27.7% of the households studied had years of crop farming experience of 1-5 years, 6-10 years, 11-15 years and 16 years and above respectively. This suggests that majority of the farmers had the necessary experience in crop production. The higher the farming experience the more the farmer would have gained more knowledge and technical ideas on how to undertake farming in a prudent manner [9].

Majority of the respondents had monthly income that ranged from Kshs. 5000 to 10,000 as represented by 64.7% of the total respondents. This is closely followed by farmers with monthly incomes of less than Kshs. 5,000 (16.7%) and between Kshs. 10,000 and 30,000. Other categories of households' monthly incomes were between Kshs. 30,000 and 50,000 and above Kshs. 50,000 with a representation of

4.7% and 1.3% respectively. Household's income plays a very important role in agriculture. In most cases, it can determine the extent in which farming may be done through its control of available inputs. Specialized and commercial farming normally require greater capital which can be supported best by higher family incomes.

Table-3: Farmers characteristics

Variable	Frequency	Percent
Gender		
Male	108	72.0%
Female	42	28.0%
Level of Education		
No formal education	28	18.7%
Primary	58	38.7%
Secondary	50	33.3%
Tertiary	10	6.7%
University	4	2.7%
Age		
Less than 26 years	0	0.0%
26 - 35 years	8	5.3%
36 - 45 years	29	19.3%
46 - 55 years	61	40.7%
56 - 65 years	33	22.0%
Above 65 years	19	12.7%
Marital Status		
Married	115	76.7%
Single	21	14.0%
Divorced	3	2.0%
Separated	5	3.3%
Widowed	6	4.0%
Household size		
01-May	49	32.7%
06-Oct	93	62.0%
Nov-15	8	5.3%
Years of farming experience		
1 – 5 years	17	11.3%
6 – 10 years	43	28.7%
11 – 15 years	56	37.3%
16 years and above	34	22.7%
Income per Month		
Above Kshs. 50000	2	1.3%
Between Kshs. 30000 and 50000	7	4.7%
Between Kshs. 10000 and 30000	19	12.7%
Between Kshs. 5000 and 10000	97	64.8%
Less than Kshs. 50000	25	16.6%

Types of crops grown

There were different types of crops grown as shown in Figure 1. However, this study concentrated itself on food crops (maize, potatoes, beans, sweet potatoes and cassava) and a few cash crops (tomatoes, cabbages, Kales *(Sukuma wiki)*, French beans and flowers).

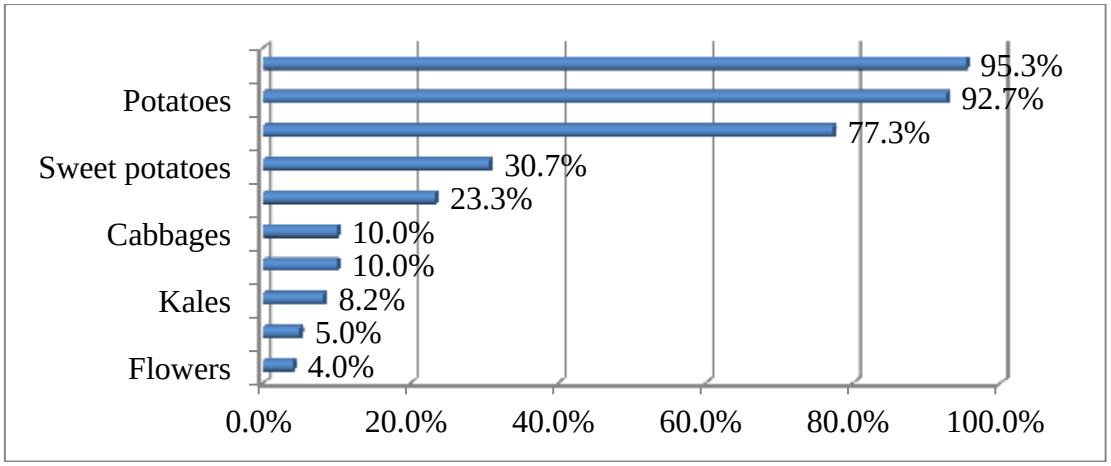

Fig-1: Types of crops grown

Figure 1 shows that the most common crop was maize and grown by 95.3% of the total respondents. This was closely followed by potatoes (92.7%) and beans (77.3%). Other crops grown included sweet potatoes (30.7%), cassava (23.3%), tomatoes (10.0%), cabbages (10.0%), Kales *(Sukuma wiki)*(8.2%), French beans (5.0%) and flowers (4.0%).The dominance of staple food crops such as maize, beans and potatoes reflects the subsistence nature of the households. Their main concern is to produce basically for home consumption.

Landownership varied in size and the distribution is presented in Table 4. It is shown that more than 70 percent of the households owned between 0.5 and 5 acres. This has an implication on the types and magnitude of the farm enterprises. Indeed Table 5 shows the different enterprises commonly engaged.

Table-4: Size of land ownership

Land size	Frequency	Percentage	Cumulative Percentage
Less than 0.5 acres	11	7.3%	7.3%
Between 0.5 acres to 1 acres	17	11.3%	18.7%
Between 1 acres to 5 acres	78	52.0%	70.7%
Between 5 acres to 10 acres	38	25.3%	96.0%
Above 10 acres	6	4.0%	100.0%
Totals	150	100.0%	

Whereas the mean farm size was 4.653 acres, the size of land that was under crop production was 2.384 acres (Table 5). The remaining piece of land was utilized through dairy production (1.132 acres), homestead (0.165 acres) and other activities (0.971 acres). Small land holdings invariably lead to more intensive land use systems. This is so because population growth forces farmers to shorten fallow periods, increase investment on land, manage soil fertility through the addition of manure [10].

Table-5: Allocation of land to different activities

Allocation of land	Minimum	Maximum	Mean	Std. Deviation
Total size of land (acres)	0.44	13.25	4.653	3.132
Land occupied by dairy production	0.00	4.00	1.132	1.169
Land occupied with homestead	0.05	1.00	0.165	0.203
Land occupied with other activities	0.00	5.25	0.971	1.192
Land occupied by crops	0.45	6.00	2.384	1.435

Results in Table 6 show that farmers were growing staple food crops (maize, potatoes, beans, cassava and sweet potatoes) and horticultural crops (tomatoes, French beans, Kales *(Sukuma wiki)*, flowers, and cabbages). The mean area planted was maize (2.34 acres), potatoes (2.12 acres) and beans (1.82 acres). Other crops grown along with the area in acres were: sweet potatoes (0.10), cassava (0.15), cabbages (0.20), flowers (0.30), tomatoes (1.65), Kales *(Sukuma wiki)* (0.35) and French beans (0.75). This implies that most farmers were planting different types of crops while distributing them in a manner that staple crops (maize, potatoes and beans) had the highest land allocation as compared to other crops.

Table-6: Area allocated to different crops

		Area covered by the crops			
Major crops grown	N	Minimum	Maximum	Mean	Std. Deviation
Maize	143	0.05	4.50	2.34	0.14
Potatoes	139	0.10	3.00	2.12	0.87
Beans	116	0.05	3.00	1.82	0.12
Tomatoes	15	0.30	2.00	1.65	1.42
French beans	8	0.50	1.50	0.75	0.47
Kales *(Sukuma wiki)*	12	0.30	1.40	0.35	0.05
Flowers	6	0.10	0.50	0.30	0.21
Cabbages	15	0.10	2.30	0.20	0.11
Cassava	35	0.05	0.30	0.15	0.09
Sweet potatoes	46	0.05	0.20	0.10	0.06

Farmers were growing crops with different maturity durations as shown in table 7. Cassava, sweet potatoes and maize had the longest duration to maturity with a mean of 7.0, 6.0 and 5.1 months respectively. The length of duration of the other crops (in months) was as follows: beans (3.0), cabbages (3.0), potatoes (3.0), Kales *(Sukuma wiki)*(3.0), tomatoes (3.0), flowers (2.5) and French beans (2.5).This may imply that most farmers prefer to grow short season crops (being diversified) except with regard to staple and traditional crops.

Table-7: Duration to maturity of the different crops

		Duration to maturity in months			
Crop name	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Cassava	35	6.0	7.0	7.0	0.37
Sweet potatoes	46	5.0	6.0	6.0	0.33
Maize	143	4.5	5.5	5.1	0.19
Beans	116	2.5	3.0	3.0	0.51
Cabbages	15	2.5	3.0	3.0	0.46
Potatoes	139	3.0	3.5	3.0	0.38
Kales *(Sukuma wiki)*	12	2.0	3.0	3.0	0.32
Tomatoes	15	2.5	3.0	3.0	0.35
Flowers	6	2.0	3.0	2.5	0.53
French beans	8	2.0	3.0	2.5	0.43

The different crops grown by farmers in the study area have varying risk implication on them. The average production risk in crop yields for each crop grown by farmers was noted to differ with most risk associated with horticultural crops and the least level of risk associated with most staple crops. Table 8 shows the stochastic simulation results for the expected production of the major crops in the study area per one acre of land with the production figures given in kilograms.

Table-8: Expected Production (Kgs/Acre) Statistics of the Major Crops Grown

Crop name	**5% Percentile**	**95% Percentile**	**Minimum**	**Maximum**	**Mean**	**Standard deviation**
Cassava	115.6	129.91	113.89	132.06	122.56	4.28
Sweet potatoes	217.15	237.04	215.01	240.28	227.1	5.85
Beans	98.3	227	81.19	250.98	165.45	38.94
Potatoes	228.7	371.2	211.94	400.55	292.41	44.17
Maize	344.7	518.3	307.56	552.38	435.12	52.33
Fruits	164.9	357.4	121.29	390.12	265.74	58.18
Flowers	80.8	330.4	56.15	257.42	267.85	65.13
French beans	105.9	327.8	64.96	357.28	236.67	67.68
Sukuma wiki	229	633	151.35	701.7	436.72	121.17
Cabbages	430	1173	268.85	1256.82	844.79	225.6
Tomatoes	462	1695	270.95	1855.23	1154.03	371.21
Sampling type: Latin Hypercube **Number of iterations: 10000**						

The above table shows that tomatoes (standard deviation = 371.21) is the crop with the greatest production risk among the major crops grown in the area. This is closely followed by cabbages (standard deviation = 225.6), sukuma wiki (standard deviation = 121.17), French beans (standard deviation = 67.68), flowers (standard deviation = 65.13), fruits (standard deviation = 58.18), maize (standard deviation = 52.33), potatoes (standard deviation = 44.17), beans (standard deviation = 38.94), sweet potatoes (standard deviation = 5.85) and cassava (standard deviation = 4.28).

Drivers of distribution and duration-based crop diversification

To determine the major determinants of distribution and duration diversification, diagnostic tests were first conducted to check the problem of multicollinearity and heteroscedasticity. The presence of multicollinearity was tested by use of Variance Inflation Factor (VIF) to test association among continuous variables (Gujarati, 2004). The problem of multicollinearity increases with larger values of VIF. Generally, if a VIF of a variable exceeds 10, the variable is said to be highly collinear. In this study, VIF values for all continuous variables ranged between 2.39 and 3.06. On the other hand, the values of mean of the factors (1/VIF) were between 0.23 and 0.79 inclusive. This means that multicollinearity was not a problem among the continuous variables.

On the other hand, the problem of heteroscedasticity was detected using White Test. Heteroscedasticity exists when the variances of all observations are not the same, leading to consistent but inefficient parameter estimates. In such a situation, the estimated standard errors may lead to invalid inferences [11]. In this test the regression was run and standard errors obtained. The squares of the errors were regressed on the constant and all other explanatory variables. The null hypothesis was then tested as likelihood. Since the p-value for the chi-square was not significant, then the null hypothesis of homoscedasticity between the variance of the errors and the independent variable was not rejected. Consequently, all the explanatory variables were entered and the equation fitting the Tobit Regression Model was estimated.

To evaluate the determinants of distribution and duration-based diversification, Tobit regression model was used. The distribution-based diversification was computed using Entropy index. The variable was zero in the case of complete specialization and was equal to log (N) in the case of complete diversification. Sample means of dependent and explanatory variables used in Tobit regression are presented in Table 9.

Table-9: Sample means of dependent and explanatory variables used in Tobit model

Variable	Mean	Std. Deviation
Dependent		
Distribution-based diversification	0.369	0.003
Duration-based diversification	0.187	0.010
Independent		
Production risk (RISK)	0.619	0.013
Gender of household head (GENDER)	0.680	0.451
Marital status of household head (MARIT)	0.740	0.986
Age of household head (AGE)	54.173	9.054
Education of household head (EDUC)	9.360	2.950
Household income (INCOM)	8170.30	1775.00
Household size (HHSIZE)	6.460	2.242
Size of land (LAND)	4.653	3.132
Crop farming experience (EXPER)	17.800	3.668

Determinants of Distribution-Based Diversification

In analyzing the determinants of distribution based diversification, the variables relating to production risk (RISK), level of education (EDUC), household average income per month (INCOME) and farm size (LAND) were found to be significant at 1% and 10% level implying that these variables are the important factors that influence farmers' decision to diversify in crop production with respect to their distribution. These results are presented in Table 10.

The coefficient for age (AGE), gender (GENDER), marital status of the household head (MARIT), crop farming experience (EXPER) and household size (HHSIZE) were not significant indicating that were not important factors in influencing farmers' decision to diversify with respect to distribution of crops.

The coefficient of production risk (RISK) was positive and significant at 1% level, implying that increases in the production risks would lead to increases

in distribution diversification of crops. This situation is especially true to the smallholder farmers who are risk averse. The idea of diversification is to reduce the dispersion of the overall return by selecting a mixture of activities that have net returns with low or negative correlations. Diversification may be managed to result to a risk-efficient combination of farm activities [12].

Table-10: Tobit Estimates of variables influencing distribution diversification

Explanatory variables	Coefficient	Std. Err.	T-values	P> |t|
Production risk (RISK)	0.001***	0.001	3.37	0.001
Gender of household head (GENDER)	0.005	0.004	1.34	0.182
Marital status of household head (MARIT)	0.005	0.020	0.27	0.786
Age of household head (AGE)	0.001	0.001	0.62	0.540
Education of household head (EDUC)	-0.110***	0.013	-8.83	0.001
Household income (INCOM)	-0.058*	0.031	-1.88	0.063
Household size (HHSIZE)	0.017	0.010	1.64	0.285
Size of land (LAND)	-0.038*	0.022	-1.74	0.084
Crop farming experience (EXPER)	0.022	.0261	0.85	0.395
Constant	0.649	0.243	2.67	0.009
LR chi-square	161.96			
Sample size	150			
Log likelihood	-19.871			
Pseudo R^2	0.794			

Threshold values for the model: Lower = 0, Upper = 1

***, ** and * represent level of significance at 1%, 5% and 10% respectively

The coefficient of level of education (EDUC) was negative and significant at 1% level, suggesting that farmers with higher education were less diversified. This could be attributed to the fact that higher education enables the farmer to know the benefits of specialization in crop production. They are likely to be engaged off farm and have less time to concentrate on diversification which requires close attention. These results are similar to Barrett and colleagues [13], which revealed that educational attainment was one of the most important determinants of non-farm earnings, especially in more remunerative salaried and skilled employment. The few farmers who chose to grow crops did it with less distribution diversification and more specialization. These results disagree with Mehta [14] who found that in diversification of horticultural crops in Himachal Radesh in India educated farmers were concerned about the risk from production and hence preferred to have higher level of diversity in their cropping pattern than being fully specialized in one crop.

The coefficient of farm size (LAND) was negative and significant at 10% level, indicating that farmers with larger farm size were less diversified (more specialized) than farmers with small farm size. This is probably because large sized farms are better suited for commercialized farming. Most farmers with large farms are often more wealthier. Consequently according to Hardaker and colleagues [15], farmers with large size of farms are more risk takers and may afford to grow fewer crops (less diversification).

The coefficient of monthly household income (INCOME) was negative and significant at 10% level, indicating that farmers with more family incomes were less diversified (more specialized). This may be attributed to the fact that wealthier families are more likely to withstand more production risks and thereby able to be less diversified [16].

Determinants of duration-based diversification

In analyzing the determinants of duration-based diversification, the variables relating to production risk (RISK), level of education (EDUC) and household average income per month (INCOME) were found to be significant at 1%, 5% and10% levels respectively. These variables are the important factors that influence farmers' decision to diversify in crop production with respect to the duration of cropping seasons. The results are shown in table 11.

Table-11: Tobit Estimates of variables influencing duration diversification.

Explanatory variables	Coefficients	Std. Err.	T-values	P> |t|
Production risk	-0.001***	.001	-4.32	0.001
Gender of household head (GENDER)	0.001	.002	0.12	0.905
Marital status of household head (MARIT)	0.001	.001	0.02	0.980
Age of household head (AGE)	0.001	.001	0.62	0.540
Education of household head (EDUC)	0.002**	.001	2.04	0.044
Household income (INCOM)	-0.002*	.001	-1.77	0.079
Household size (HHSIZE)	0.001	.001	0.18	0.860
Size of land (LAND)	-0.001	.001	-0.24	0.814
Crop farming experience (EXPER)	0.005	.020	0.27	0.786
Constant	0.206	.008	26.67	0.000
LR chi-square	56.12			
Sample size	150			
Log likelihood	107.065			
Pseudo R^2	0.81			

Threshold values for the model: Lower= 0, Upper= 1

***, ** and * represent level of significance at 1%, 5% and 10% respectively

The coefficient for gender (GENDER), age (AGE), marital status of the household head (MARIT), land size (LAND), household size (HHSIZE) and crop farming experience (EXPER) were not significant and thus not important factors influencing farmers' decision on crop duration diversification

The coefficient of production risk (RISK) was negative and significant at 1% level, implying that increases in the production risks would lead to decreases in duration diversification of crops. This means that households that want to reduce production risks would grow crops with long duration (such as most traditional crops and staple crops) as opposed to growing short duration crops. Households would consider long maturing crops as a risk reducing strategy because agricultural risks are more likely to wear out with time. Short season crops may not escape such risks. This is consistent with the findings of Mehta [17] who noted that horticultural crops that last shorter in the field are riskier than those that take a longer period.

The coefficient of level of education (EDUC) was positive and significant at 5% level, suggesting that farmers with higher education were more diversified as far as the duration of crops was concerned. This could be attributed to the fact that higher education enables the farmer to be in a position to grow short season crops requiring more skills. . These results are consistent with Mehta [18] who observed that horticultural crops are avoided by some farmers because of their high requirements of technology.

The coefficient of household average monthly income (INCOME) was positive and significant at 10% level, suggesting that farmers with higher incomes are more diversified as far as the duration of crops is concerned and thus can afford to grow short season crops that require a huge capital investments (in irrigation facilities), more inputs (hired labour, fertilizer and pesticides).

Conclusions and Recommendations

The study has established that production risk, level of education, household average income per month and farm size was the major determinant of crop distribution diversification. On the other hand, the variables relating to production risk (RISK), level of education (EDUC) and household average income per month (INCOME) were found to be important factors that influence farmers' decision to diversify in crop production with respect to the duration of cropping seasons. This study recommends that the government should endeavour to enlighten more farmers about the reality of production risks that may affect their crop production activities. The government should provide a conducive environment for farmers to improve their levels of education and household average income per month since these factors may help to boost diversified agriculture that lead to improved standard of living.

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