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ANALYSIS OF RISK ATTITUDE OF CEREAL/LEGUME FARMERS IN NASARAWA STATE, NIGERIA

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ABSTRACT

This study describes the socio-economic characteristics of the cereal/legume farmers in Nasarawa State, Nigeria, identify risk associated with cereal/legume enterprises; determine the risk attitude of the farmers and identify the management strategies employed in minimizing risk associated with cereal/legume enterprise in the study area. Multistage sampling technique was used for the selection of two Local Government Areas (LGAs) from each of the three agricultural zones I, II, and III, respectively. Farming communities was randomly selected from each of the sampled LGAs from which respondents were proportionately selected to make a total of 105 respondents for this study. Primary data was collected with the aid of structured questionnaire and interview schedule. The data collected was analysed using descriptive statistics, Safety-first and factor analysis. The result showed that the mean age of the farmers was 40 years, 78.1% of respondents were male and a82.9% of them were married. The result from safety first approach revealed that 27.6% and 61.0% of the farmers were risk averse and risk neutral respectively. Production, Financial and human (theft, bush burning) risks form 31.4%, 34.3% and 8.6% of all risks associated with cereal/legume enterprises respectively. Factor analysis result indicated that Spreading sales, family member working off-farm and early planting of crops were employed for managing the risks. It is recommended that Government in conjunction with the donor agencies should make provision for interest free credit facilities at the appropriate time to enable them take as much risk as possible to increase their Cereal/Legume production.

Key words: Risk, Analysis, Cereal, Legume, Farmers

INTRODUCTION

Agricultural risk is associated with negative outcomes stemming from unpredictable incidences of pests and diseases attack, climatic factors not within the control of farmers and fluctuation in both input and output prices (World Bank, 2005). These makes it difficult for farmers to predict with certainty the amount of output their production process will yield. Risk in agricultural production can be exogenously-caused or endogenously-induced.

Exogenous risks**;** are the risks that arise from extreme weather conditions such as drought, freezes, or excessive rainfall at harvest or planting or threats of disease outbreaks and pest infestation independent of farmers' production decisions (Nmadu *et al.,* 2012). This occurs despite the control measures employed and from failure of equipment and machinery such as Tractor, Knapsack sprayer and irrigation pump (Bonanno *et al.,* 2018). While; Endogenous risks; are the risks that are **i**ncurred solely by production decisions such as; which crops to plant, which inputs to use, when to plough, when to sow, when to irrigate, how much crop to sell now and how much crop to store for later sales (Nmadu *et al.,* 2012). These makes agriculture unique because it allows farmers' and households to make these decisions their selves or in consultation with relatively small numbers of neighbours, friends, or partners. The primary drivers of decisions are the farmer's motives, beliefs, perceptions and preferences (Martin-Clouaire, 2017).

The growing quest for agricultural and environmental sustainability has drawn the attention of researchers and policy makers to the need to reconsider farming production systems in this regard, legumes and specifically fodder legumes play a major role in contributing to the development of sustainable agricultural production by accumulating nitrogen (N) in the soil (Papendiek *et al.,* 2016). Permanent soil cover through planting cover crops and the use of other mulching materials on the field even after harvest helps in managing soil temperatures, incidence of weeds and promote a healthy bio-balance in the soil to improve crop yields (Gunjal, 2016).

Intercropping systems mostly involve cereal-legumes, particularly maize/soybean, maize/ cowpea, maize/groundnuts, millet/groundnut, and rice pulses (Matusso *et al.,* 2012). Cereals and legumes have become a popular combination among farmers probably due to the ability of legumes to combat erosion and raise soil fertility status (Matusso *et al.,* 2012). Development of a feasible and economically viable intercropping system largely depends on the adaptation

of planting pattern and selection of compatible crops (Seran and Brintha, 2009). The use of fodder legumes brings about significant advantages in terms of overall environmental sustainability. Green bio-refineries like any other bio-refinery creates a wide range of substitutes for fossil-based products, generating marketable products (food, feed, materials, and chemicals) and energy (fuels, power, heat) from biomass (Papendiek *et al.,* 2016).

Production risk such as excessive and insufficient rainfall, extreme temperature, pest and diseases as well as poor prices which occur as a result of bad weather and unfavourable market forces are peculiar to agricultural enterprises (World Bank, 2015). These can be remedied by the introduction of improved crop varieties and production techniques with potentials of improving farmers' income and household food reserve (Alex *et al.,* 2016). With the threat of climate change and increasing demands placed on agro ecosystems, farmers will need to adapt to new conditions and the unrelenting requirement of fertility inputs to improve food production. Incorporation of legumes into cereal based cropping systems has frequently been advocated as a means of increasing soil fertility and agro ecological resilience for farmers with limited access to nutrient resources (Thierfelder and Wall, 2012). Many legumes utilized to improve soil fertility do not provide edible grain, while smallholder farmers are often forced to prioritize food production and crop sales over potential soil fertility benefits (Snapp *et al.,* 2002). As a result, recent farmer-participatory research efforts have focused on incorporating soil fertility building legumes into maize-based cropping systems using approaches that do not compromise food crop production (Snapp *et al.,* 2010).

Cereals and legumes intercropping system is beneficial to the smallholder farmers in the low-input and or high-risk environment of the tropics due to its ability to contribute to addressing the problem of declining level of soil fertility for risk minimization and profit maximization (FAO, 2010). Cereal- legume mixture is the most popular mixed cropping in Northern and middle belt zones of Nigeria due to the beneficial impact of legumes on the cereals such as provision of vegetation cover to check erosion as well as competitive effect of weeds on available water and nutrients (Saleh *et al.,* 2016).

Lack of clear understanding of farmers' attitudes towards risks remains an important factor inhibiting increased agricultural productivity. Increasing crop production to take advantage of ban on crop importation largely depends on the risk attitude and risk management strategy of the farmers. Therefore this research described the socio-economic characteristics of the cereal/legume farmers in Nasarawa State; identify risk associated with cereal/legume enterprise; determine the risk attitudes of the farmers and, identify the management strategies employed in minimizing risk associated with the enterprise in the area.

According to Ashraf and Routray (2013).Risk management involves selecting from various alternatives for reducing the effects of risk on a farm to minimum bearable, and by so doing, affecting the farm's welfare position. Risk management strategy includes: Diversification (reduce risk within the farm's operation), Production contracting (transfer risk outside the farm), and Maintaining liquid assets (build the farm's capacity to bear risk).

Le and Cheong (2009) measured risk levels and efficacy of risk management strategies of
Catfish farming in Vietname with the aid of descriptive statistics and reported that price variability cost of operating inputs, high fish mortality rates as results of low quality of fingerlings and diseases attack were the most important sources of risk. While farm management, disease prevention, and selection of high quality inputs such as good quality water source, well-fortified feed and fingerlings with proven qualities) were the most important risk management strategies perceived by the farmers'. Jirgi (2013) carried out a research on the risk attitude of mono croppers and inter-croppers in Kebbi State Nigeria using experimental gambling approach, factor analysis and found out that farmers' practicing intercropping system were more statically significant risk averse compared to mono-croppers. The results suggested that those into intercropping system adopted diversification to safe guard against crop failure. Fakayode *et al.* (2012) examined the risk attitude of farmers' in factors influencing risk attitude and farmers' perception on major sources of production and market risk of fruit and vegetable farmers' in Osun State, Nigeria. Kruskal-Wallis ranking analysis was used for analysing the data collected and opined that damages due to pest and disease attack, traditional method of crop production and dependence on weather were perceived as the risk sources. While maintenance of customer relationship with the traders, selling at harvest period and at the markets closer to them were the major risk management strategies adopted by the farmers' against yield loss.

Amaefula *et al.* (2012) used safety first principle to investigate the impact of insurance on risk attitude of the respondents and reported that intermediate risk takers with overall mean of 2.47 and 20.6 per cent were low risk-averse. The analysis of the risk attitude coefficient found out that 40.2 per cent of the respondents were intermediate risk-takers and 39.2 per cent were highly risk-averse. Age, education, experience and stock size were the socio-economic factors that significantly and positively influenced the risk attitude of the respondents in the study area. Access to agricultural insurance impacted positively on the attitude of farmers' to production risk. Oparinde (2016) examined risk attitudes and poverty status nexus among fish farmers' in Ondo State of Nigeria using descriptive statistics. Foster Greer Thorbecke poverty measures, safety-first model and ordered probit regression were employed to analyse the data. Results showed that 42.5 per cent of the respondents were poor, natural risks and economic risks constituted 29.0 per cent and 30.4 per cent of their risk sources. The results also showed that 57.0 per cent of the farmers' were highly risk-averse. Experience, household size, income diversification, poverty status, membership of association and tertiary education significantly affected the attitudes of the fish farmers' in the study area.

MATERIAL AND METHODS

Study Area

This study was conducted in Nasarawa State with her headquarters in Lafia. It is centrally located in the Middle Belt region of Nigeria made up of 13 LGAs. The State lies between latitude 7° 45^{l} N and 9° 25^{l} N of the equator and between longitude 7° E and 9° 37^{l} E of the Greenwich meridian. It shares boundary with Kaduna State to the North, Plateau State to the East, Taraba and Benue States to the South while Kogi and the Federal Capital Territory flanks it to the West. The State has a total land area of 26,875.59 square kilometres, it has maximum and minimum temperature of 81.7^{o} F and 16.7^{o} F respectively and receives Rainfall between the range of 131.73mm to145mm (Nasarawa State Government, 2018).

Sampling Techniques and Sample Size

The study employs multistage sampling technique for data collection. The first stage involves the random selection of two Local Government Areas (LGAs) from each of the three agricultural zones. In the second stage, farming communities were randomly selected from each of the sampled LGAs and the third stage involved the random selection of respondents from each of the sampled communities proportionate to their frames following (Tanko and Kpange, 2014), as in equation (1) to give a total of 105 respondents for this study.

$$nh = \frac{n.Nh}{N} \quad 1$$

Where: nh= sample size to be determined, n=targeted number of respondents, Nh= sample frame (total number of farm households in each community), N=finite population (total number of farm households in the study area).

Table 1: Sampling frame and sampling size of cereal and legume producers in Nasarawa States

Sampled Stat	Agricultural Zone	Selected LGAs	Sampling frame	Sampling size
Nasarawa	Western	Awe	12,212	35
	Central	Nasarawa Eggon	14,251	41
	Southern	Obi	9,582	28
Total			**36,042**	**105**

Source: Nasarawa State government,(2018)

Data Collection

Primary data were collected with the aid of structured questionnaire complemented with interview schedule and administered by the researchers and trained enumerators to elicit relevant information from the respondents. Information were collected on the farmer's responses to each of the statements corresponding to the socio-psychological attribute and his rating of the item that conveys his attitude towards risk, based on his tendency to adopt the specific risk management tool that the item reflects.

Data Analysis

The data were analysed with the use of descriptive statistics such as frequency distribution and percentages to describe the socio-economic characteristic of the farmers, Safety-first behavioural approach for determining the risk attitude of the farmers while factor analysis was used in the determination of risk management strategies employed by the farmers.

Specification of safety-first behavioural Approach model

The safety-first behavioural approach was used to generate risk aversion parameter (Ks) for each respondents following Sadiq *et al.* (2018) as expressed below:

$$L_s = \frac{1}{\theta}\left[1 - \frac{R_k N_k}{R_z \beta_k \mu_z}\right] \quad (2)$$

Where; Ls is the risk index of k^{th} farmer, θ is variance parameter; R_k is the unit price of the chosen most influential input for K^{th} farmer; N_k is quantity of the chosen most influential input of the K^{th} farmer; R_z is the unit price of the output of K^{th} farmer; B_k is the elasticity coefficient of output with respect to the chosen input; and, μ_z is the mean of the output. Following Sadiq *et al.* (2018), the risk aversion parameter Ls was used to classify farmers into three distinct categories as expressed below;

0<L*s*<*0.4* = Risk preference
0.4<L*s*<*1.2* = Risk neutral
1.2<L*s*<*2.0* = Risk aversion

Factor analysis was used to determine the risk management strategies for the cereal/legume based farmers. It conceived that standard parametric statistical measures are suitable for ordinal variables in the form of Likert-type scale (1 not important, 2 less important, and 3 very important) (Jirgi, 2013). It reduces attribute space from a larger number of variables to a smaller number of factors which makes a "non-dependent" procedure (that is, it does not assume that a dependent variable is specified). The data was screened to check for outliers that might attenuate the result following Jirgi (2013).

Specification of factor analysis model

$$Y_1 = \beta_{11}X_1 + \beta_{12}X_2 + \ldots + \beta_{1n}X_n \quad (3)$$

$$Y_2 = \beta_{21}X_1 + \beta_{22}X_2 + \ldots + \beta_{2n}X_n \quad (4)$$

$$Y_3 = \beta_{31}X_1 + \beta_{32}X_2 + \ldots + \beta_{3n}X_n \quad (5)$$

$$Y_n = \beta_{n1}X_1 + \beta_{n2}X_2 + \ldots + \beta_{nm}\beta_{nm} \quad (6)$$

Where: $Y_1, Y_2, Y_3, \ldots, Yn$ = observed variables (management strategies),
$B_1, \beta_2, \beta_3, \ldots, \beta n$ correlation co-efficient,
$X_1, X_2, X_3, \ldots, Xn$ = unobserved underlying factors of risk management strategies

RESULTS AND DISCUSSION

The result in table 2 shows that the mean age of the sampled cereal/legume farmers in Nasarawa State was 40 years. This means that there is high prospect of increasing agricultural practice in the study area as majority of them are at their youthful age of farming. There is also prospect of increasing their output to take advantage of the agricultural transformation agenda. This corroborates the findings of Mazibuko *et al.* (2018) in their study on socio economic factors influencing small holder farmers agricultural infrastructure availability, accessibility and satisfaction in North West province in South Africa and reported that about 59 per cent of the farmers were within the age range of 41 to 60 years. Table 2 revealed that male famers constituted about 78.1 per cent of respondents. Implying, women were not left of the cereal/legume production as they claimed up to 21.9 per cent of the sampled cereal/legume farmers in the study area. Manza *et al. (*2019) in the assessment of socio economic characteristics of participated farmers in commercial agriculture development project in Kaduna State, Nigeria reported that 89.5%, of the participants were male. While the female constituted about 10.5% of the total participants.

Table 2: **Description of Socio-economic characteristics of the respondents in Nasarawa State**

Age (years)	**Frequency**	**Percentage**
20-29	7	6.7
30-39	42	40.0
40-49	41	39.0
50-59	14	13.3
60-69	1	1.0
Mean	**40**	
Total	**105**	**100.0**
Gender		
Female	23	21.9
Male	82	78.1
Total	105	100.0
Experience		
1-3	4	3.8
4-6	33	31.4
7-9	10	9.5
>9	58	55.2
Mean	16	
Total	105	100.0
Marital status		
Married	87	82.9
Divorce	11	10.5
Widow	7	6.7
Total	105	100.0
Household size		
1-3	13	12.4
4-6	31	29.5
7-9	16	15.2
>9	45	42.9
Mean	9	
Total	105	100.0
Cooperative members ship		
non-member	72	68.6
Member	33	31.4
Total	105	100.0
Extension visit		
No	83	79.0
Yes	22	21.0
Total	105	100.0
Access to credit		
No	56	53.3
Yes	49	46.7
Total	105	100.0
Educational status		
Non formal	29	27.6
Adult	1	1.0
Primary	7	6.7
Secondary	35	33.3
Tertiary	33	31.4
Total	105	100.0
Source of farm land		
Personal	43	41.0
Inheritance	51	48.6
Purchase	8	7.6
crop lease	3	2.9
Total	**105**	**100**

Source: Field Survey, 2020

Table 2 revealed that 42.9 per cent of the respondents have more than nine dependents. Meaning there will be availability of labour in the study area in future if they will not be pre occupied by other off farm activities. The table 2 also shows that 68.9 per cent of the respondents were none members of cooperative society. Implying, their chances of gaining incentives from the government and the donor group are very limited as the incentives are mostly channelled through cooperative societies to the beneficiaries. The Table further showed that only 21 per cent of them had contact with the extension agents. This implies that they may lack ideas of modern technologies to improving their cereal/legume output which can in turn affect their risk preferring attitude.

The result in table 2 revealed that less than half of them (46.7%) have access to credit facilities to finance their enterprise. This could be as result of failure to meet up with the required terms of the financial institutions and poor trust between the local money lenders and some of the farmers.

Table 2 further revealed that majority of the respondents can read and understand and can be communicated as most of them possessed one form of education and or the other. The table also revealed that about 41per cent and 48.6 per cent of them acquired their farm lands through personal (indigene) and inheritance respectively.

Risk Associated with Cereal/Legume Production

The study finds out that 34.3 per cent of the farmers in Nasarawa State suffered financial risk. This could be as result of their in ability to fulfil the credit terms. Meaning the respondents were founding it hard to access credits to finance their farming activities. The result also revealed that 31.4 per cent of them were challenged by production risk. This could be as result of effect of adverse weather condition on the crops. The result in table 3 Shows that about 25.7 of the cereal/legume farmers were faced with market risk. Implying, the producers were not in absolute control of their produce and sometime have to take what the buyers agrees to offer per unit of their commodity. The result also shows that the respondents were challenged by human activities which constituted about 8.6 per cent of identified risks associated with the enterprise in the study area. Implying, theft and bush burning are to some extent affecting the cultivation of cereal and legume in study area as it most time lead to total loss on the farm.

Table 3: Risk associated with cereal/legume enterprise in Nasarawa State

Types of risk	Frequency	Percentage
Production	33	31.4
Market	27	25.7
Financial	36	34.3
Human	9	8.6
Total	105	100.0

Source: Field Survey, 2020

The result in table 4 also shows the risk attitude of the sampled cereal/legume farmers in Nasarawa State. The result indicates that about 27.6 per cent of the respondents were risk averse farmers with negative attitude towards risk. This could be as result of their poor financial status limiting them to subsistent level of cereal/legume production to satisfy the need of their immediate family with none or little surplus to offer for the market. Table 4.6 further shows that 61.0 per cent of the respondents were risk neutral in status while about 11.4 per cent of them were found to be risk lovers who have the mind-set of taking a higher entrepreneurial risk to produce for the market. These are the profit oriented farmers who produce at commercial quantity for both domestic and international market.

Table 4 Result from safety first analysis

Risk attitude	Frequency	Percentage
risk averse (< 0)	29	27.6
neutral (0 to <1)	64	61.0
preference (>=1)	12	11.4
Total	105	100.0

Source: Field Survey, 2020

Risk Management Strategies of Cereal/Legume Farmers in Nasarawa State

Table 5 shows the Kaiser-Meyer-Olkin (KMO) test measures of degree of inter-correlation among the

variables and the appropriateness of factor analysis in Nasarawa State. Table 5 has a calibration value of 0.756, signifying that the inter-correlation and appropriateness of variables were high for factor analysis. Bartlett's test which tests the statistical probability of whether the correlation matrix correlates with variables was an identity matrix (at the level of 0.000) indicating a significant relationship between the variables (Adewunmi *et al.*, 2019).

Table 5: Analysis of risk management strategies of cereal/legume farmers in Nasarawa State

Variables	**Economics /Institutional factor**	**Off-farm/ spiritual factor**	**Environmental factors**
Selling before harvest	0.5101		
Spreading sale	0.4415		
Training and education	0.5860		
Adashe contribution	0.5731		
Cooperative society	0.7764		
Storage programme	0.7525		
Gathering market information	0.6604		
Price support	0.5615		
Borrowing cash or grain	0.4776		
Reduce consumption	0.7389		
Family members working off farm	0.4712		
Household working off farm		0.7515	
Investing of off farm		0.7841	
Faith in God		0.6975	
Fertilizer provision by self			0.4828
Intercropping			0.5718
Spraying for disease and pest			0.4581
Planting drought tolerant varieties			0.4572
Planting early maturing varieties			0.4489
Early planting	1210.62		
Chi2 (χ2)	7.23867	2.26355	1.78515
Eigen-value	16.1	13.5	43.4
% of variance	0.756		
Kaiser-Meyer-Olkin Test	1198.202		
Bartlett's Test of Sphericity (χ2			

Sources: Field Survey, 2020**.**

The result of the principal component analysis using the varimax rotation method isolated 3 underlining or principal factors for each of the 19 variables. These three underlying factors explained 75.6% of the variation in the data. That is to say that the factors that meet the cut-off criterion with Eigen-values greater than 1 are generally considered satisfactory. The extracted factors and their respective factor loadings exclude those whose absolute loading value was less than 0.40 according to Kaiser's rule of thumb (Farinde and Alabi, 2015). Those factors include: Economics/Institution factor (1), Off-farm/Spiritual factors (2) Environmental factors (3)

The economic/institution factor has an Eigen-value of 7.23867, loaded with eleven items and explained 16.1% variance of the inhibiting factors. Specific factors that revolve around economic and institutional factors with high factor loadings were gathering market information (0.7764), insured crop (0.7525), planning expenditure (0.7389), price support (0.6604), cooperative society (0.5860), storage programme (0.5731) borrowing cash or grain (0.5615), investing

of off farm (0.5101), selling of asset (0.4776), reduce consumption (0.4712) and adashe contribution (0.4415). This finding agreed with Aminu *et al.* (2019) who stated that access to market information, insured crop and price support were strategies used to risk management in Ogun State.

The second factor (Off-farm/Spiritual factors) has an Eigen-value, loaded with three items and explained 13.0.05 variance of the inhabitants' factors. Specific factors that revolve around Off-farm/Spiritual factors with high factor loadings were faith in God (0.7841), household working off farm (0.7515) and family members working off farm (0.6975). The use of God to calm tension, risk and uncertainty is deeply rooted among majority of rural farming populace in Nigeria. Also, diversify into off-farm activities such as trading, artisan, transportation and tailoring could be used to handle risk and uncertainty faced by farmers'. This is in line Etuk *et al.* (2018) who suggested that off-farm income as livelihood diversification strategy among farm households in Akamkpa Local Government Area of Cross River State.

The third factor (Environmental factors) has an Eigen value 1.78515, loaded with five items and explained 43.4 per cent variance of the inhibiting factors. The specific factors that revolved around environmental factors with high loading were; use of manure (0.5718), Fadama cultivation (0.4828), planting drought tolerant varieties (0.4581), planting early maturing varieties (0.4572) and early planting (0.4489). The use of manure (organic and inorganic fertilizer) can boost the nutrient capacity of the soil. Moreover, engaging in Fadama could make food available throughout the year and also reduce over dependency on rain among farmers'. Also, drought resistance crops such beans and maize could reduce over-dependents on rain by farmers'. Planting of early maturing and early planting could reduce the risk and uncertainty faced in the farm. This finding is in consonance with that of Aminu *et al.* (2019) who reported that use of manure and planting early maturing crops avert risk for farmers' in Ogun State, Nigeria Agboola (2015) reported that use of fertilizer and early planting are the major ways of preventing risk among farming households in FCT, Abuja, Nigeria.

CONCLUSION AND RECOMMENDATIONS

Risk is an essential factor in investment decision making to reduce fundamental problems and encourage agricultural entrepreneurship. Lack of clear understanding of farmers' attitudes towards risks remains an important factor inhibiting increased agricultural productivity. Very few of the cereal/legume farmers were risk preferring in behaviour to invest into cereal/legume production at commercial quantity. Spreading sales of farm produce, cooperative membership, borrowing cash/grain, and working off-farm, early planting and planting of draught tolerant crops were measures of managing risk associated with the cereal/legume farmers in the study area. The Government should through extension agencies make adequate provision for training the Cereal/Legume farmers in the modern technics of cereal and legume mix that will guarantee a more promising output so as improve their risk preferring behavior. The federal government should also implement price control policies to remedy input price fluctuations that is ravaging agricultural sector in order to encourage increase in production at a minimized cost.

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