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Risk Attitude of Monocrop and Intercrop Farmers in Kebbi State, Nigeria

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Abstract
The research investigated the risk attitude, of farmers in Kebbi State, Nigeria, with the aim of generating reliable information on the influence of risk attitudes of the decision-making behaviour of farmers. Agricultural production is highly characterized by risks for this reason, farmers' attitudes towards risk is imperative in understanding their behaviour towards the adoption of new technology and managerial decisions. The technique applied in order to achieve the objectives of the study was Experimental Gambling Approach. Data to conduct the research was obtained mainly from primary sources through a questionnaire survey of 256 farmers, comprising 98 monocroppers and 158 intercroppers. The results from the study revealed that all the farmers exhibit some level of risk aversion. The intercroppers were statistically significantly more risk-averse than the monocroppers. Risk attitude influences the decisions farmers make in the production process and should be considered when formulating agricultural policies.
Keywords: Risk attitude, monocroppers, intercroppers and experimental gambling approach.

1. INTRODUCTION

Agricultural production is highly characterized by risks which range from adverse weather, pests to diseases, which in turn lead to price uncertainty (Musser and Patrick, 2002; Glauber and Collins, 2002; Ayinde *et al*., 2008). For these reasons, farmers' attitudes towards risk is imperative in understanding their behaviour towards the adoption of new technology and managerial decisions (Ayinde *et al*., 2008; Binici *et al*., 2003; Knight *et al*., 2003; Liu, 2008; Alpizar *et al*., 2010). For example, the more risk-averse a farmer is, the more likely the farmer is to make managerial decisions that emphasize the goal of reducing variation in income, rather than the goal of maximising income; the converse is also true (Binici *et al*., 2003).

Depending on their ability to absorb risk and their psychological attitudes or preferences towards risk, the risk inherent in a new technology or input choice will affect farmers differently (Binswanger and Sillers 1983; Knight *et al*., 2003). Risk is a characteristic of agricultural production. Several factors influencing production are not dependent upon the actions of a producer (OECD, 2009). Hardaker *et al*., (1997) define production risk as the risk that comes from the unpredictable nature of weather and uncertainty about the performance of crops or livestock.

Bamire and Oludimu (2001) and Ojo (2005) argue that the limited success of Nigeria in rural development programmes is a result of the absence of a prior analysis of attitudes towards risk inherent in new technologies and the failure to ascertain the farmers' trade-offs between risk and return in traditional agriculture. A lack of clear understanding of farmers' attitudes towards risks remains an important factor inhibiting increased agricultural productivity. It is not in any way difficult to point out that the observed resource use of farmers reveals the underlying degrees of risk preferences (Olarinde *et al*., 2008). Although some researchers have quantified risk attitudes of farmers in Nigeria, it is evident that most of the studies applied the Safety First Behaviour and Portfolio model to measure risk attitude of farmers (Alimi and Ayanwale, 2005; Ajetumobi and Binuomote, 2006; Ogunniyi and Ojedokun, 2012). The Safety First Behaviour model is criticised owing to the fact that it is difficult to determine the relative influence of risk and other factors on the decisions of the individuals, while the Portfolio behaviour is criticised because it does not produce very detailed information (Binswanger, 1981). No reliable knowledge is available on these issues. Most government programmes are designed without giving consideration to farmers' characteristics, for example, the risk preference of the farmers

(Olarinde *et al*., 2007). It is therefore important to investigate the risk attitude of farmers in Kebbi state using reliable methods so as to inform policy decisions that will help farmers improve their productivity.

1.1 METHODOLOGY

1.1.1 Study area

The study was carried out in Kebbi State, located in the north-western part of Nigeria (Figure 1.1). Kebbi State is situated between latitudes 10° 8′ N – 13° 15′ N, and longitudes 3° 30′ E – 6° 02′ E. The State is bordered by Sokoto and Zamfara States to the east, Niger State to the south, Benin Republic to the west and the Niger Republic to the north. The population of the State was 3 238 628 in 2006 (NPC, 2006), and projected to be 3 952 766 in 2012 (UNFPA, 2012). The State occupies an area of about 36 229 square kilometres. The major cities in the State include Birnin Kebbi (State capital), Argungu Yauri, Koko, Zuru, Jega.

Kebbi State falls within the dry savannah agro-ecological zone of Nigeria (Tanko and Jirgi, 2008). The average annual rainfall is 1 020 mm (CBN, 2009). Kebbi State experiences peak rainfall between July and August while harmattan (cold season) is usually from November to February and is characterised with strong winds. The mean annual temperature of about 27°C is recorded in all locations, but temperature is generally high. However, during the harmattan season, the lowest temperature is 21°C. Temperatures can go up to 40°C during the months of April to June (Onlinenigeria, 2012). The average relative humidity during the wet season is 80 %, but it is generally low (40 %) for most of the year. The variation in relative humidity explains the hot, dry environment which is in sharp contrast to a hot, humid environment in the southern parts of Nigeria.

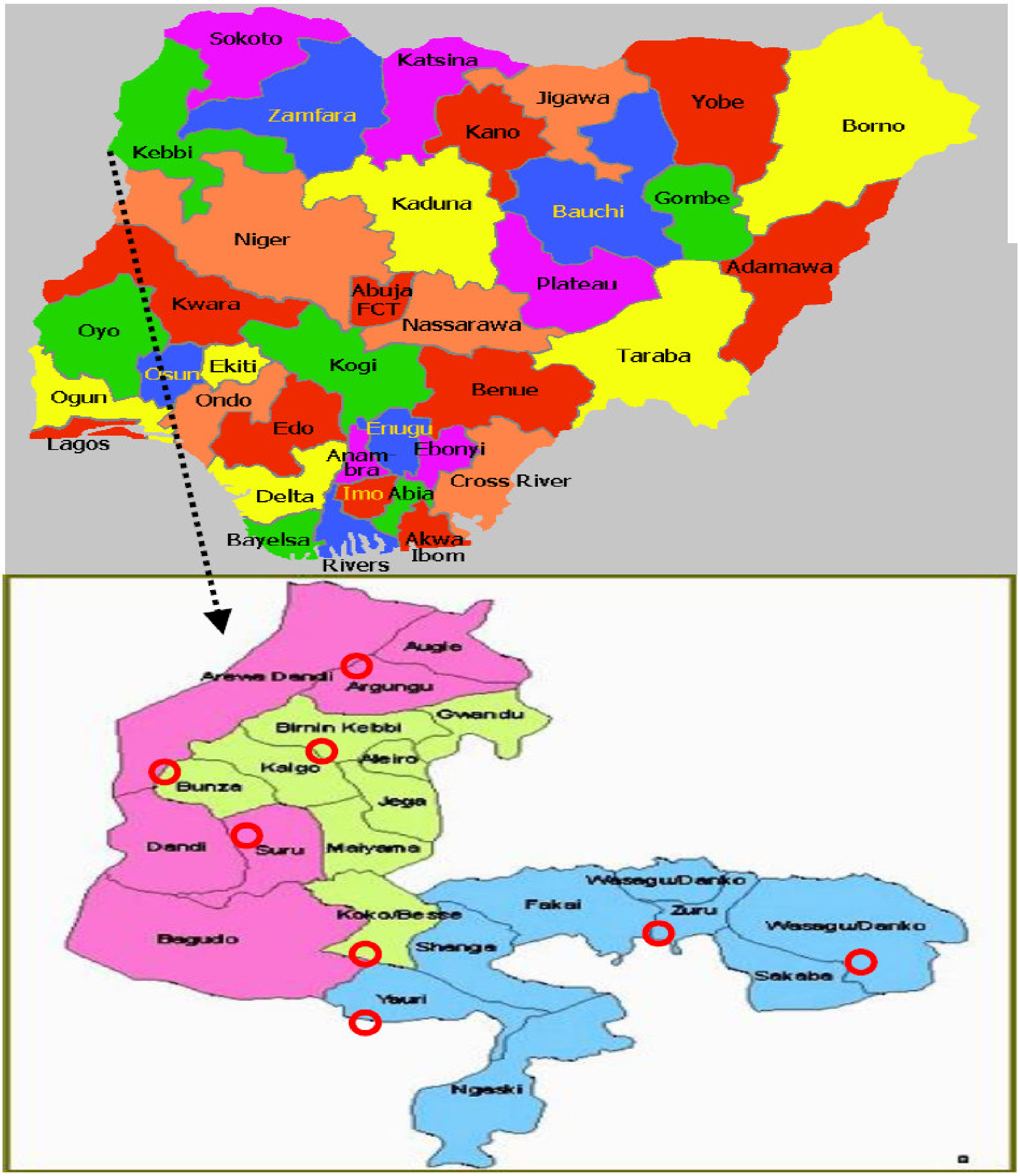

Figure 3.5 Map of Nigeria and Kebbi State.

Represent the selected local government areas for the study.

Source: http://www.nigeriahc.org.uk/images/nigeria_map_m.gif

The climate favours both crop and livestock production. Agriculture is the major source of revenue and the backbone of the economy of the State. Over two-thirds of the population are engaged in agricultural production with about 80 – 90 % of the population living in the rural areas (Tanko, 2004). The natural vegetation of Kebbi State consists of northern guinea savannah in the south and southeast, and Sudan savannah in the northern part (Onlinenigeria, 2012). The soils in the area range between sandy, loamy and clayey. The sandy soils are well drained and erodible. The clayey soils are common in the *fadama* areas. *Fadama* are flood plains and low-lying areas underlined by shallow aquifers and are found along Nigeria's river systems, which are used for small scale irrigation (Ingawa *et al,* 2004; Ayanwale and Alimi, 2004).

One of the major problems associated with the physical environment in the State is desertification. Desertification refers to a phenomenon of impoverishment of the terrestrial environment under the impact of unfavourable weather and human activities (Odiogor, 2010). About 35 million people are located in the 11 States in northern Nigeria where desertification is evident and are facing threats of hunger and extreme weather conditions as a result of desert encroachment on arable lands (Danjuma, 2012). The evidence of desertification is seen through the incidence of wind erosion, dune accumulation and exposure of lateritic ironstone on the landscape. The main causes of desertification are: too much demand for fuel wood, bush burning, unreliable rainfall patterns and grazing (Danjuma, 2012). The establishment of shelter belts, woodlots, roadside plantations and forest reserves are some of the measures taken by the government to mitigate the menace. Other ecological problems affecting the State, *inter alia*, are flooding, pest infestation and erosion. Since 1988, flooding has become an annual event. The 2010 flood was devastating for the State, causing destruction of croplands and livestock within the flood plains, settlements bordering them and loss of lives (Babajide and Aderemi, 2012). The common pests in the study area are grasshoppers, caterpillars and quella birds.

Intercropping is the predominant type of farming system, especially rain fed, with the use of traditional inefficient hand tools (KARDA, 2009). Monocropping is also practised by the farmers. Millet, sorghum, maize, rice, groundnuts and cowpeas are the dominant rain fed crops in the State. Other crops grown under rain fed conditions include wheat and soya beans. Onions and peppers, which have some ecological limitations, are the dominant irrigated crops. Several crop mixtures are practiced by the farmers. These typically include, sorghum/cowpeas, millet/sorghum, sorghum/groundnuts, millet/cowpeas, sorghum/cowpeas/rice (KARDA, 2009). The dominant *fadama* crops in the State, which include peppers, onions, ginger, tomatoes, lettuce, okra and sugarcane, are planted usually as sole crops. Tree crops, such as mango, guava, pawpaw and cashew, are cultivated by farmers in the State.

Animal husbandry is also practised by farmers in the State (Tanko, 2004). Livestock, such as cattle, sheep, goats and poultry (mostly local breeds), are raised on a small scale on free range systems. Complementary relationships exist with livestock fed on crop-residues, which contributes to draught power, manure, source of protein, income, savings and reserve against risk (Upton, 2004). Livestock also provide different products and services to people, including socio-cultural roles (ILRI, 2002).

1.1.2 Data collection

The study is based on primary data gathered through a questionnaire survey of the sampled farmers in the study area. A formal survey was conducted using a structured questionnaire through personal interviews by the researcher and trained enumerators. The questionnaire was administered using a single visit approach.

1.1.3 Questionnaire development

The questionnaire used for the study was developed by the researcher. Relevant literature (Binswanger 1980, 1981; Meuwissen *et al*.,2001) was consulted in order to identify the variables to include in the survey. Some of the questions asked in the questionnaire covered: personal characteristics of the respondents, the experimental gambling game. The questions were designed to answer the objectives of the study. The questionnaire was developed in English and interpreted to the sampled farmers in *Hausa* (the common local language in Kebbi State) by the researcher and trained enumerators.

A pilot study was conducted to test the validity of the questionnaire. Ten farmers were randomly selected from each of the four agricultural zones in Kebbi and the questionnaire was administered to them. The responses from the respondents were checked to see if the replies were as required in the questions. The questions that seemed not to be clear to the farmers were reconstructed.

1.1.4 Sampling technique

A multi-stage sampling technique was used to select 256 farmers comprising 98 monocrop farmers and 158 intercrop farmers. The reason for the sample size chosen is that there are more intercrop farmers than monocrop farmers in the State. In the first stage, the four agricultural zones were purposively selected in order to have a good representation of all the agro-ecological zones in the State. The second stage involved a random selection of two Local Government Areas (LGAs) from each of the four agricultural zones. In the third stage, four villages were randomly selected from each of the two LGAs. The fourth stage involved the random selection of the 98 monocrop farmers and the 158 intercrop farmers. Since the population of the LGAs is not homogeneous, the number of farmers selected from each of the selected LGAs was calculated using the formula:

$$P = \frac{S}{N} \times n$$

Where P = Proportion, S = Desired sample size, N = Total population, n = Population of LGA in question.

1.1.5 The survey and data collected

The survey was carried out in January to February, 2012 and data were collected on the risk attitude of the farmers using the experimental gambling approach in 2011 cropping season. The household heads were interviewed by the researcher and the trained enumerators. Data were collected on farmers' risk preference.

1.1.6 Determining risk preferences of farmers in the study area

This section describes the procedure used in order to achieve the objective of the study, which is to explore the risk attitudes of the farmers. "Risk attitude means there is a fear trade-off/greed between making money and avoiding potential unfavourable consequences as a result of taking risks" (FinaMetrica, 2008).

Hardaker *et al*. (2004) have described three main attitudes towards risk, namely risk averse, risk neutral, and risk seeking or risk loving. The risk-averse individual is one who is wary of taking risks. The risk-neutral is a person who only cares about the expected pay off of an investment and not the risk that must be taken to achieve the investment objective. A risk-seeking individual is one who actively engages in risky investments. The measure of the amount of risk an individual is willing to take in order to achieve an investment goal is referred to as risk preference (Hoag, 2009).

The principal theory that is used to guide decision-making under risk is subjective expected utility theory (SEU). Chances of bad versus good outcomes can only be evaluated and compared knowing the decision maker's relative preferences for such outcomes. According to the subjective expected utility (SEU) hypothesis, the decision maker's utility function reflects his or her attitude towards risk (Anderson *et al*. 1977). Although expected utility theory has come under criticism (Rabin and Thaler, 2001; Allais, 1984; Rabin, 2000), the SEU hypothesis nevertheless remains the most appropriate theory for prescriptive assessment of risky choices (Hardaker *et al*, 2004; Meyer, 2001). The SEU was selected for this study based on the fact that the theory is more appropriate for perspective assessment of risk choices.

1.1.7 Measuring of risk aversion

In terms of utility framework, risk aversion can be measured by partial risk aversion, which is fixed regardless of the level of payoff (Menezes and Hanson, 1970; Zeckhauser and Keeler, 1970).

Let W stand for final wealth which consist of an initial wealth (φ), and the certainty equivalent of the prospect of new wealth M , by definition,

$$W = \varphi + M \qquad \text{...1}$$

An individual's utility function is given by, $U(W) = U(\varphi + M)$.

From the utility function, relative risk aversion (RRA) can be defined. Relative risk aversion traces the behaviour of an individual as both wealth φ and the size of the prospect M rise (Binswanger, 1981). The measure of relative risk aversion is expressed as:

$$RRA = -W\frac{U^{"}}{U^{'}} = WQ \qquad \text{...2}$$

Where Q represents absolute risk aversion (Pratt, 1964).

$U^{'}$ and $U^{"}$ are the first and second derivatives of the utility function.

Evaluating RRA at point ($\varphi + M$), this becomes:

$$RRA = (\varphi + M)Q \qquad \text{...3}$$

The partial relative risk aversion (PRRA) was proposed by Menezes and Hanson (1970) and Zeckhauser and Keeler (1970) following RRA. PRA is abbreviated as partial risk aversion. Partial risk aversion traces the behaviour of an individual when the scale of the prospects M changes by a certain factor but wealth φ remains the same (Binswanger, 1981). Partial risk aversion, S , is given by:

$$S(W+M) = -M\frac{U^{"}(W+M)}{U^{'}(W+M)} \qquad \text{...4}$$

Where W is certain wealth and M is the certainty equivalent of a new prospect.

A risk-averse individual would have increasing partial risk aversion for increases in the prospects M (Menezes and Hanson, 1970; Miyata, 2003). For the game used in this study, each risk aversion category corresponds to an interval of partial risk aversion (S)[1]. Wealth W and the certainty equivalent of a new prospect M were provided.

1.1.8 Elicitation of risk attitudes: the experiment

A simple lottery-choice experiment approach that allows the measurement of the degree of risk aversion over a wide range of payoffs was used in this study. The approach is similar to the lottery-choice data from a field

[1] A constant risk aversion function (CRA) was used in order to obtain a unique measure of partial risk aversion associated with the indifference points between two alternatives (Binswanger, 1981). CRA is expressed as: $U = (1-S)M^{1-S}$

experiment by Binswanger (1980). The lottery-choice procedure was recently used by Yesuf (2007), Kouamé (2010) and Miyata (2003). In the experiment, respondents were presented with a set of alternative prospects involving hypothetical money payments.

The payoffs were varied from very low levels (slightly above the daily wage of an unskilled rural labourer) to high levels (slightly above the minimum monthly wage rate of a civil servant). It is, however, believed that the payoffs provided the incentive for respondents to reveal their true preferences. The respondents' choices between the given alternative prospects is taken as an indication or sign of the degree of the individuals' degrees of risk aversion. The experiment was administered as part of the questionnaire undertaken by the sampled farmers in Kebbi State, Nigeria.

In this experiment, each subject was offered a series of choices from sets of alternative risky prospects, such as the set presented in Table 1. The game lists six prospects, each with 50 % probability of winning. Each respondent was asked to choose his or her preferred alternative from the six prospects: O, A, B, C, D, or E. The risk aversion coefficients of the respondents were calculated using a constant partial risk aversion (CPR) utility function of the form $U = (S-1)M^{1-S}$, where S is the coefficient of risk aversion, and M is the certainty equivalent of a prospect. The partial risk aversion coefficients were computed for each indifference point (CE) at each game scale. The upper and lower limits of the CPR coefficients for each prospect are presented in Table 1.

Table 1 Classification of risk aversion coefficients of the respondents, Kebbi State, January 2012

Choices	Bad outcome "Heads"	Good outcome "Tails"	Expected gain	Standard deviation or spread	S Approximate partial risk aversion coefficient	Risk classification
O	₦5000	₦5000	5000	0	∞ to7.51	Extreme
A	₦4500	₦9500	7000	3535.534	7.51 to 1.77	Severe
B	₦4000	₦12000	8000	5656.854	1.77 to 0.84	Intermediate
C	₦3000	₦15000	9000	8485.281	0.84 to 0	Moderate
D	₦1000	₦19000	10000	12727.92		Inefficient
E	₦0	₦20000	10000	14142.14	0 to - ∞	Neutral to preferring

Source: Adapted from Binswanger (1980). Note that 1$ US = ₦160 in 2012.
Note: 1$ US = ₦0.550 in 1980

From Table 1, it will be seen that alternative O is the safest alternative in this game. An individual who chose alternative O would simply get N5000, whether he got heads or tails with the flip of a coin, i.e. participation in the game would result in an automatic and sure increase in wealth by N5000. If the individual chose alternative A instead of O, his or her expected gain would increase by N2000, but a bad luck alternative (heads) would give him or her N500 less in return than the person would have received with the safe alternative O. It means that, if the respondent chose A instead of O, the standard deviation in gain increased from O to N3535.534. The same explanation holds for the successive alternatives, A to B, B to C, and C to D: the expected gain increases, and so does the spread between the two outcomes. Alternative D and E have the same expected gain, but alternative E has a larger spread. According to Kouamé (2010), when risk is viewed in terms of uncertainty in gains, income or wealth, as in utility based choice theories, the alternatives involve more risk the further down you get in Table 1. The degree of concavity of an individual's utility function determines the choice the individual will make. The classification of the different prospects from extreme risk aversion (alternative O) to neutral to preferring (alternative E) is the same as the one used by Binswanger (1980), Miyata (2003) and Kouamé (2010). The inefficient choice D was treated as its neighbouring choice E and was considered as risk neutral in the subsequent analysis Binswanger (1980). The intervals of the partial risk aversion (S) presented in Table 1 correspond to the risk aversion class. The values of S are used as one of the explanatory variables in multiple regressions, technical efficiency and cost efficiency models.

1.1.9 RESULTS AND DISCUSSION

1.1.10 Risk attitude of the respondents

The first objective of this study was to determine the risk attitudes of the farmers in Kebbi State. The risk classification of the farmers, based on the risk aversion coefficients, are presented in Table 2.

Table 2 Risk classification of the farmers, Kebbi State, January 2012

Risk classification	Monocroppers		Intercroppers		Aggregate	
	n = 98	%	n = 158	%	n = 256	%
Extreme risk averse	2	2	5	3	7	3
Severe risk averse	4	4	37	23	41	16
Intermediate risk averse	17	17	37	23	54	21
Moderate risk averse	49	50	67	43	116	45
Total risk averse	**72**	**73**	**146**	**92**	**218**	**85**
Neutral to preferring risk	26	27	12	8	38	15
Total neutral to preferring	**26**	**27**	**12**	**8**	**38**	**15**
χ^2	8.52**					
χ^2 critical value	3.84					
Degrees of freedom (n-1)	1					

Computed from survey data, 2012

Table 2 上方 shows that 50 % of the monocrop farmers are in the moderate risk averse class and about 27 % in the neutral to preferring risk class. The table also shows that a greater percentage of the intercroppers are either in the severe (23 %) or intermediate (23 %) classes, compared to severe (4 %) and intermediate (17 %) risk averse classes for monocroppers. This supports the assumption that farmers practising intercropping do so because they are more risk averse. The risk-averse farmers are apprehensive about taking risk. Risk-averse farmers would tend to safeguard against crop failure by diversification in cropping system. This result is in line with the findings of Olarinde *et al*. (2007) who reported that maize farmers in the dry savannah zone of Nigeria are lowly (8 %), intermediately (42 %), and highly risk averse (50 %). Binici *et al.* (2003) found that not all, but the majority, of the farmers were risk averse.

The chi-square test was used to ascertain whether there were significant differences between the risk averse and neutral to preferring risk averse classes for the monocrop and intercrop farmers. The results show that there were statistically significant differences between the risk averse and neutral to preferring class of the monocroppers and intercroppers. The intercroppers are statistically significantly more risk averse than the monocroppers.

1.1.11 CONCLUSION AND RECCOMENDATION

The results of the risk attitudes of the farmers reveal that 92 % and 74 % of the intercroppers and monocroppers are risk averse, respectively. There is a statistically significant difference between the risk averseness of the monocroppers and intercroppers. This implies that the intercroppers were statistically more risk averse than their counterpart monocroppers. Risk attitude influences the decisions farmers make in the production process and should be considered when formulating agricultural policies.

1.1.12 SUGGESTION FOR FURTHER RESEARCH

Since the experimental gambling approach, used to investigate the risk preference of the farmers was limited to farmers in Kebbi State, there is a need to expand such comprehensive research to other States of Nigeria, so as to obtain more reliable and comparable knowledge for all the farmers in Nigeria. This information will be useful for national policy development on these issues.

REFERENCES

Ajetumobi, J.O. and Binuomote, S.O. 2006. "Risk Aversion among Poultry Egg Producers in South Western Nigeria". *International Journal of Poultry Science* 5(6). pp. 562-565.

Alimi, T. and Ayanwale, A.B. 2005. "Risk and Risk Management Strategies in Onion Production in Kebbi State of Nigeria". *J. Soc. Sci.* 10(1). pp. 1-8.

Allias, M. 1984. "The Foundations of the Theory of Utility and Risk". In *Progress in Utility and Risk Theory*. O. Hargen & F. Wenstrop (eds). Dordrecht: Reidel. pp. 3-131.

Alphizar, A., Carlsson, F. and Naranjo, M. 2010. "The Effect of Risk, Ambiguity and Coordination on Farmers' Adaptation to Climate Change: A Framed Field Experiment". Paper Presented at the International Workshop on "*The Social Dimension of Adaptation to Climate*" Jointly Organised by the International Canter for Climate Governance, Centro EuroMediterraneo Per: Cambiamenti Climatic and Fondazione Eni Enrico Mattei, Venice, February 18-19, 2010.

Anderson, J.R., Dillon, J.L. and Hardaker, J.D. (1977). *Agricultural Decision Analysis*. Ames: Iowa State University Press. pp 344.

Ayanwale, A.B. and Alimi, T. (2004). "Impact of the National *Fadama* Facility in Alleviating Rural Poverty and Enhancing Agricultural Development in South-Western Nigeria". *J.Soc.Sci.* 9(3). pp. 157-161.

Ayinde. O.A., Omotesho, A.O. and Adewumi M.O. (2008). "Risk attitudes and Management Strategies of

Small-scale Crop Producers in Kwara State, Nigeria: A Ranking Approach". *African Journal of Business Management* 2(12). pp. 217-221.

Babajide, S.O. and Aderemi, M.O. (2012). "Water and disaster management in Nigeria: The real estate sector perspective". In *Water and Society*. D.W. Pepper & C.A. Brebbia (eds). WIT Press.

Bamire, A.S. and Oludimu, O.L. (2001). "Determinant of risk among smallholder farmers: A Nigeria case study". *The Interface* 1. pp. 72-80.

Binici, T., Koc, A.A., Zulauf, C.R. and Bayaner, A. (2003). "Risk Attitudes of Farmers in Terms of Risk Aversion: A Case Study of Lower Seyhan Plain Farmers in Adana Province, Turkey". *Turk J of Agric For* 27. pp. 305-312.

Binswanger, H.P. (1980). "Attitudes towards Risk: Experimental Measurement in Rural India". *American Journal of Agricultural Economics* 62. pp. 395-407.

Binswanger, H.P. (1981). "Attitudes towards Risk: Theoretical Implications of an Experiment in Rural India". *The Economic Journal*. pp. 867-890.

Binswanger, H.P. and Sillers, D.A. (1983). "Risk Aversion and Credit Constraints in Farmers' Decision Making: a Reinterpretation". *The Journal of Development Studies* 20(1). pp. 5-21.

Central Bank of Nigeria. (2009). *Annual Report and Statement of Accounts*. Abuja: CBN.

Danjuma, J. (2012). Katsina Moves to Check Flooding, Desertification. *National Mirror*, Thursday, 22/05/2012.

FinaMetrica, (2008). www.myrisktolerance.com. Accessed on: 20 May, 2011.

Glauber, J.W. and Collins, K.J. (2002). "Crop Insurance Disaster Assistance, and the Role of the Federal Government in Providing Catastrophic Risk Protection". *Agricultural Finance Review* 62. pp. 81-101.

Hardaker, J.B., Huirne, R.B.M. and Anderson, J.R. (1997). *Coping with risk in agriculture*. Wallingford, UK: CAB International. pp. 274.

Hardaker, J.B., James, W.R., Lien, G. and Schumann, K.D. (2004). "Stochastic Efficiency Analysis With Risk Aversion Bounds: A Simplified Approach". *The Australian Journal of Agricultural and Resource Economics* 48(2). pp. 253-270.

Hoag, D.L. (2009). *Applied Risk Management in Agriculture*. Baco Raton, London, NewYork: Taylor & Francis Group. pp 1-403.

ILRI. (2002). *Mapping Poverty and Livestock in the Developing World*. International Livestock Research Institute.

Ingawa, S.A., Oredipe, A.A., Idefor, K. and Okafor, C. (Editors). (2004). *Facilitators Project Implementation Manual. Second National Fadama Development Project (Fadama II)*. Abuja, Nigeria: Federal Ministry of Agriculture and Rural Development.

Knight, J., Weir, S. and Woldehanna, T. (2003). "The Role of Education in Facilitating Risk-taking and Innovation in Agriculture". *The Journal of Development Studies* 39(6). pp. 1-22.

Kouamé, E.B. (2010). *Risk, Risk Aversion and Choice of Risk Management Strategies by Cocoa Farmers in Western Cote D'ivoire* AERC Collaborative Phd Programme. pp. 1-35. University of Cocody. Available: http://www.csae.ox.ac.uk/conference/2010-EDiA/paper/267-kouame.pdf. Retrieved on 25th March, 2011.

Liu, E.M. (2008). *Time to Change What to Sow: Risk Preferences and Technology Adoption Decisions of Cotton Farmers in China*. Working Papers (1064). Department of Economics, Princeton University.

Menezes, C.F. and Hanson, D.L. (1970). "On the Theory of Risk Aversion". *International Economic Review* 11. pp. 181-187.

Meuwissen, M.P.M., Huirne, R.B.M. and Hardaker, J.B. (2001). "Risk and Risk Management: An Empirical Analysis of Dutch Livestock Farmers". *Livestock production science* 69. pp. 43-53.

Meyer, J. (2001). "Expected Utility As a Paradigm For Decision Making in Agriculture". In *A Comprehensive Assessment of The Role of Risk in US Agriculture*. R.E. Just & R.P. Pope (eds). Boston: Kluwer. pp. 3-19.

Miyata, S. (2003). "Household Risk Attitudes in Indonesian Villages". *Applied Economics*

Musser, W.N. and Patrick, G.F. (2002). "How much Does Risk Really Matter to Farmers?" In *A Comprehensive Assessment of the Role of Risk in US Agriculture*. R.E. Just & R.D. Pope (eds). Boston: Kluwer. pp. 537-556.

OECD, (2009). Managing Risk in Agriculture: A Holistic Approach (Extracts). OECD, Paris. Pp1-66.

Odiogor, H. (2010). "Special Report on Desertification in Nigeria: The sun eats our Land". Special Report, May 3, 2010, 7:29Pm. Vanguard newsstand, Nigeria.

Ogunniyi, L.T. and Ojedokun, I.K. (2012). "An Investigation of Production Risk and Economic Efficiency of Rice Farmer in Kwara State, Nigeria". *Int J of Agric.* 5(1). pp. 35-43.

Ojo, S.O. (2005). "Analysis of Productivity and Risk Factors in Commercial Poultry Production in Osun state, Nigeria". *Journal of Food, Agriculture and Environment* 3. pp. 130-133.

Olarinde, L.O., Manyong, V.M. and Okoruwa, V.O. (2007). "Analysing Optimum and Alternative Farm Plans for Risk Averse Grain Crop Farmers in Kaduna State, Northern, Nigeria". *World Journal of Agricultural Sciences* 4(1). pp. 28-35.

Onlinenigeria, (2012). http.www.onlinenigeria.com.

Rabin, M. (2000). "Risk Aversion and Expected-utility Theory". *Econometrica* 68(5). pp. 1-14.

Rabin, M. and Thaler, R.H. (2001). "Anomalies: Risk Aversion". *Journal of Economic Perspectives* 15. pp. 219-232.

Tanko, L. (2004). Optimum Combination of Farm Enterprises in Kebbi State, Nigeria: A Linear programming Approach. Unpublished Ph.D Thesis, Department of Agricultural Economics. Michael Okpara University of Agriculture Umudike, Nigeria.

Tanko, L. and Jirgi, A.J. (2008). "Economic efficiency among small holder arable crop farmers in Kebbi state, Nigeria". *Continental J. Agricultural Economics* 2. pp. 4-22.

Upton, M. (2004). "The Role of Livestock in Economic Development and Poverty Reduction". *PPLPI Working Paper No. 10*. United Nations Food and Agricultural Organisation (FAO),

Roma, Italy, February (2004). Available from: http://agecon.lib.umn/cgi-bin/pdf. Retrieved on 27th March, 2007.

Yesuf, M. (2007). *Risk Aversion in Low Income Countries: Experimental Evidence from Ethiopia*. Discussion Paper 715. International Food Policy Research Institute, Environment and Production Technology Division.

Zeckhauser, R. and Keeler, E. (1970). "Another Type of Risk Aversion". *Econometrica* 38. pp. 661-665.

Figure 1.6 Map of Nigeria and Kebbi State Source: http://www.nigeriahc.org.uk/images/nigeria_map_m.gif
. Represent the selected local government areas for the study.