ANALYSIS OF RISK IN COWPEA PRODUCTION IN KWARA STATE, NIGERIA: A Target- MOTAD Model Approach

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ABSTRACT

Risk of biological pests and vectors remains a major constraint to cowpea production in Nigeria. The management of the risk of these pests and vectors in cowpea production requires biological, chemical and economic knowledge. The economic aspect which is the basis of this study deals with risk management in cowpea production. Therefore, this study examines the production risk problems facing cowpea farmers in Kwara state in Nigeria.
Using the Target – MOTAD model, we determined the set and level of production activities that optimize cowpea production returns in the study area. Our findings also revealed that brown cowpea is less risky than white cowpea; and that unavailability of labour is one of major problems faced by cowpea farmers during pesticide application.

KEYWORDS: Risk, Cowpea Production, Target-MOTAD model,

INTRODUCTION

A farmer, when embarking on any productive activity, is uncertain about what the actual outcome will be. "Uncertainty and risk go hand in hand with farming. They are pervasive feature of the farm environment. How to handle the risk and uncertainty is the most difficult aspect of farm-system planning and management (Anderson and Dillion, 1972). Moreover, risk is a measure of the effect of uncertainty on the decision maker (Martin Upton 1997). Risk has been seen to alter production decisions (Roosen and Henneessy 2003).
The very act of requesting for advice indicates that the farmer feels inadequate about his own estimate of response for decision making. A farmer is likely to attach importance to different sources of information and thereby making wrong decision. Inadequate decision making in dealing with risk involved in cowpea production, as it needs an additional requirement such as use of pesticide, will result to imbalance between capital invested and the return. Thus, some farmers forsake planting some crops which require additional factor of production such as pesticide in spite of their usefulness for human consumption; and the prices of those few crops that are available become exorbitant.
Consequently, we examined in this study the risk involved in decision making in cowpea production. More specifically, we measured the level of risk involved and calculated the set and level of production activities which maximizes cowpea production under risk.

LITERATURE REVIEW

In the analysis of risk in farm management, there have been series of decision theories which help in analyzing and measuring the 'riskiness' of a decision in farm. The earliest of these theories is Bernoullian decision theory (1738) which is a normalized approach of risky choice based upon the decision maker's personal strength of belief (or subjective probability). The Bernoullian decision theory is characterized by separations of risky decision-making into two components of subjective probability and utility function of farmers. The latter is heavily criticized (Young 1979, Binswanger 1980).The doubt surrounding the validity of directly elicited utility functions have encouraged researchers to seek indirect measures of risk preference. Studies of this nature has either focused on input utilization   (Pope 1982, Christianson et al 1991, Chamber and Quiggin 2000, 2001, Lamb 2003) and output supply of individual farmers (Brink and MacCarl, 1978, Newbery and Stiglitz 1981; Chavas and Holt, 1990, Marra and Carlson 1990 Mishra, and Goodwin 1997, Mishra and Moreharf 2001). Moreover, in recent times utility function has been shown to overestimate risk aversion in the study of Just and Pope (2003). However the subjective probability has been proved fertile in literature (Dillion 1971, Webster 1978, Anderson et al 1977, Morgan and Henrion 1992 and Anderson et al 1997).
Although there are differences of opinion as to how risk should be measured, some argue that it is variation or instability of income, while others claim that it is the possibility of disaster or ruin. Both of these alternatives are explorable. But in this study variation of return in terms of mean Absolute standard deviation (MAD) is used to measure risk, in which case we rely on a priori assumption of the farmer as a risk averter. And in any case there is fairly general agreement that most people including farmers are risk aversed (Wiens 1976; Dillion and Scandizzo 1978, Uwaka 1980 Walker and Jodha 1982, Panel 1990 Moschini and Hennessy 2002).
Several risk models were being used to evaluate optimal condition under risk, but the safety first concept models has proved fertile in literature because of its computational efficiency and generation of solutions that meet the second degree stochastic dominance (SSD) test (Tauer 1983, Berbel 1990 Anderson et al 1997). Under safety first rules, the decision maker is concerned with the probability of economic or financial variables falling below critical or target levels. (Qiu et al 2001).
A variant of the safety-first concept is the minimization of total absolute deviation (MOTAD) introduced by Hazel 1971. It involved the dual criteria of maximizing net returns and minimizing the variance of net returns. The MOTAD model was also modified by Tauer in 1983 through his target-MOTAD model approach. Target – MOTAD was found better than MOTAD (Waits et al (1984). More also, Mara and Carlson, 1987, Chavas and Holt 1990, Foster and Rauser 1991, Adubi and Atobatele 1992, Adubi 2000, Ayinde et.al 2004) have made used of this Approach.

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METHODOLOGY

This study was carried out in Kwara State of Nigeria. The state comprises of sixteen local Government Areas which have been divided into four zones by the Kwara state Agricultural Development Project (KWADP). These zones are: zone A, zone B, zone C zone D. Zone C was purposively selected for this study because it is known to be much involved in cowpea production than the other zones. Furthermore three local Governments were randomly selected in the zone and thirty respondents in each zone were randomly interviewed with the use of structured questionnaire.

Target – MOTAD model was employed as the model. The farmer is assumed to evaluate risk on the basis of safety-first criteria; that is, he minimized the probability of his farm output in return falling below his subsistence requirement. Mathematically, the model is stated as :

$$\text{Max E}(Z) = \sum_{j=1}^{n} c_j x_j \quad \text{------------------ (1)}$$

Subject to:

$$\sum_{i=1}^{m} \sum_{j=1}^{n} a_{ij} x_j \leq b_i \quad \text{------------------ (2)}$$

$$i = 1, \text{-----------}, m \quad j = 1, \text{-----}, n$$

$$T - Y_r^+ - Y_r^- \leq 0 \quad \text{------------------ (3)}$$

Or
$$Y_r^+ + Y_r^- > T \quad \text{------------------ (3)}$$

$$\sum P_r Y_r^- = \alpha \quad \text{------------------ (4)}$$

$$\alpha = (M \longrightarrow 0)$$

$$X, Y > 0$$

Where

E (Z) =expected returns of the plan or solution to the plan in C_j
c_j =expected returns of activity j
x_j = level of activity j
a_{ij} =technical requirement of activity j for resource i
b_i =level of resource i
T = target level of returns in naira (it was derived from mean absolute deviation).
C_{rj}=returns of activity j for state of nature or observation r (N)
Y^+= deviation above expected returns
Y^- = deviation below expected returns
Pr = probability that state of nature or observation r will occur
α =a constant parametererized from M to 0

Note $\quad Y_r = \sum_{j=1}^{n} (c_{ij} - c_j) x_j$

m =number of constraints or resource equation
s =number of state of nature or observation.
M =large number (represents the maximum total absolute deviation of return of the model)

The mean absolute deviation (MAD) or D for an activity (j) and for the whole farm over all states of nature (years) was also employed in the study and is estimated respectively as follows;

$$D = \frac{1}{n} \sum_{j=1}^{n} D_j \quad \text{------------------ (5)}$$

$$D_j = S^{-1} \sum I (C_{rj} - C_j) X_j I \quad \text{------------------ (6)}$$

Where:
s = number of states of nature.
D = estimated mean absolute deviation of return to the farm (Hazel, 1973).
Other variables are defined above.

RESULT AND DISCUSSION

Generally, the major source of risk in agricultural enterprises is that of production, finance and marketing. To be precise about the research findings, the major production risk in cowpea production are the incident of fire out break during the dry season, the cattle attack, and risk of pesticide application. The risk of pesticide application includes the use of fake pesticides, wrong application interval, incidental rain immediately after application and phytoxicity

PRODUCTION CONSTRAINT

The major constraints in cowpea production are land, labour capital and pesticide cost.
Land availability and fertility in any agricultural production enterprise are considered to be the greatest factor. Majority of the farmers in the study area are not facing the problem of land availability but rather the problem of soil fertility and this significantly affects their crop yield. The average available land for majority of cowpea farmer is 2.5 hectares but only average of 1.0 is being put into use for cowpea production.
The availability of labour is very important in cowpea production. Based on experience with farmers, it is clear that one of the major elements of risk in cowpea production is the availability of labour for each stage of production activities. The production activities whose labour must be readily available include herbicide applications, planting, weeding, insecticide application and harvesting. Table 1 shows the respondent's view about the risk involved as a result of labour unavailability.

Table 1: LABOUR IN-AVAILABILITY RISK

ACTIVITIES	PERCENTAGE OF RESPONDENT
PLANTING	20%
WEEDING	30%
PESTICIDE APPLICATION	90%
HARVESTING	60%
STORAGE	30%

Source: Field Survey Data 2004

From table 1, it is revealed that majority viewed pesticide application as the one with highest risk in term of labour unavailability.

RISK COEFFICIENT

To determine the risk coefficient, the historical gross margin of the cowpea enterprise from 1998 – 2003 was computed from KWADP staff appraisal record and result shown in table 2.

Table 2: HISTORIRICAL GROSS MARGIN (1998 – 2003) (N)

Crop Variety	1998	1999	2000	2001	2002	2003
Brown cowpea (BCWP)	26,208.80	31,841.60	24,506.0	18,883.04	17,869.50	19,189.20
White cowpea (WCWP)	24,737.94	27,796.34	22,405.2	17,090.40	14,878.86	11,947.20

The gross margin for each year was deflated by using consumer price index in which the price index of 1998 forms the base year. Table 3 revealed deflated gross margin

TABLE 3 DEFLATED GROSS MARGIN

Crop Variety	1998	1999	2000	2001	2002	2003	Average
BCWP	16079.00	19112.60	14231.13	10662.36	9934.12	10431.18	13408.40
WCWP	15176.65	16668.48	13011.15	9650.14	8271.35	6494.46	11548.07

From the deflated gross margin mean absolute deviation (MAD) were calculated via expected gross margin deviation. Table 4 revealed the mean Absolute Deviation of the cowpea

Table 4: MEAN ABSOLUTTE DEVIATION (MAD)

Cowpea Variety	MAD
BCWP	2486.80
WCWP	3409.36

From table 4, it is revealed that white cowpea is more risky than brown cowpea.

OPTIMAL PLAN
In calculating the optimal plan using Target – MOTAD model, the initial matrix is shown in Table 5.

Table 5: Target-MOTAD PROGRAMMING INITIAL MATRIX

	BCWP	WCWP	Constraint Level
Profit	19189.2	11947.2	Maximize
Land	1	1	2.5
Labour	86	84	260
Capital	23068.33	22436.13	49250
Cost of Pest Control	6886	6875	15000
Risk coefficient	3065.85	3409.36	3237.6
Probability	510.98	0	∞

Source: Field Survey Data 2004; Where ∞ = 5485 $\longrightarrow 0$

The result of the optimal plan for the farm with the specified constraint is as shown in table 6.

TABLE 6: OPTIMAL FARM PLAN MATRIX

	Land (ha)	Labour (man-day)	Capital (₦)	Cost of Pesticide (₦)	Gross Margin (₦)
BCWP	2.13	183.18	49135.54	14,667.18	40,872.99
WCWP	0.00	0.00	0.00	0.00	0.00
TOTAL	2.13	118.18	49135.54	14,667.18	40,872.99

The solution of the Target- MOTAD programming problem revealed that a farmer in the study area should devote 2.13 ha of land to producing Brown Cowpea (Table 6). The solution allowed that 118.18 man-day should be used. The result also takes cognizance of risk as cowpea with less risk was chosen, as it was also revealed in table 4 that Brown Cowpea is less risky.

CONCLUSION AND RRECOMMENDATION

The study revealed that Brown Cowpea production is a little lower than that of white cowpea. It was found out that Target MOTAD model is applicable to cowpea production as it allowed for cowpea variety that is less risky. The result of this study revealed the optimal plan, subjected to the specified constraints, which stipulates the specific level of input necessary to maximize the gross margin. The risk involved in cowpea production will be minimized if the optimal plan is followed.
Based on our findings, it is recommended that government should ban the importation and production of fake chemical and farmers should be educated to take to necessary information to obtain the optimal plan. Researchers and extension agents should work hand - in - hand to provide necessary advice to enhance farmer's decisions.

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