

Risk Efficiency as an Aid to Evaluation of On-Farm Research Results : A Preliminary Inquiry into Use of the Expected Value-Variance Criterion for Recommendations on Soft Wheat Production in the Abda and-Chaouia Regions of Morocco

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I- INTRODUCTION

The purpose of applied research is identification of technologies which will advance progress in development in the LDC's. That farmers are risk averse and make decisions based on trade-offs between the utility of expected income from alternative activities and the variances in those incomes has been long established. Now the efficient set theorem must be applied to on-farm technology results testing to identify risk efficient alternatives. This is necessary to extract maximum amount of information from experimental results. Extraction efficiency is critical in the LDC context for two reasons :

- 1- The severe limits on budgets make funds precious.
- 2- The effects of a false recommendation due to poor quality information may be virtually irreversible.

The on-farm research strategy now being implemented by agronomic researchers both supports and moves risk analysis in new directions. It consists of performance evaluation trials of technologies previously developed at experimental stations. This approach is new and provides the biological information on farmer management without which risk efficient technologies cannot be identified. It also serves as a means of spreading news of innovations directly to farmers. The strategy involves farmers in the entire trial process from installation of the experiment to obtaining the results of the harvest. Account is also taken of the mutual interests of the farmers and the researchers, and a basis for future cooperation is developed.

Results of the experiments carried out this year reported in this paper were derived from joint efforts of Aridoculture Center scientists and cooperation farmers in two regions. Ten farmers in the Abda region and eight in the Chaouia region were involved. The farmers were supplied with the inputs necessary to test changes in production practices which accompanied the new technologies. They provided the land, labor, and bore all other operating costs. This built into the work a commitment by the farmers.

II- STUDY AREAS

Dryland agricultural research is being conducted at two experiment stations situated in Abda Region of Safi Province and Chaouia Region of Settat Province, Morocco. Abda Region receives low rainfall, averaging 275 mm per year.

Chaouia Region rainfall is higher, averaging 386 mm annually (Watts and Mourid, 1988). The Abda is at the lower margin of feasible rainfed arable agriculture. The Chaouia is further up the feasibility gradient. In each case distribution is as important as total amount.

The study areas were chosen for three reasons. First, scientists working at the field experiment station in each have tentatively identified technologies performances under field conditions in the same environments in which may increase agricultural production. These they were developed is necessary before their discrimination elsewhere. Second, it is judged desirable to increase the familiarity of farmers in the regions with the research activities as an aid to gaining their interest. Finally, economic information on present practices exists against which innovations performances can be compared.

III- STUDY LIMITATION

Each reader must understand this paper is strictly expository. No recommendations are being made which can be conveyed to a farmer for implementation. Nor are there representations of the value implicit in a particular line of inquiry. There are three critical limitations to be recognized, dictated by the fact that this is dryland research in an extremely variable environment.

The first limitation is that the tests in each region were installed on homogeneous soils specific to that region. Inferences about the technologies performances on other soils in each region cannot be made. Second, parallel research indicates that the ten farmer replicates used in this work is a barely sufficient number. Third, the data is for only one year of experimentation. No inferences can be made about the technologies' economic performances over time, and only after two years will it be possible to begin calculating how many years of work will be needed to generate

valid estimates of the economic parameters of interest. Parallel research at the Aridoculture Center and other Moroccan institutions suggests ten years of data are needed to adequately represent activities' biological responses and economic decision making.

IV- STUDY METHODOLOGY

The economic analysis is based on costs and returns for experimental data generated from on-farm trials conducted by ten small farmers each in the Abda and Chaouia Regions. Comparison with actual practises of small medium, and large farmers are based on regional cost-of-production surveys conducted in 1986 and 1988, respectively. The costs were adjusted to prices levels paid for variable inputs and outputs in the regions during the 1989 on-farm experiments. Since the three years were very similar agronomically yields were left unchanged.

The expected value-variance criterion based on activities' gross margins and their variances was chosen to determine the risk efficient cropping activities. This method has been extensively tested and validated both historically and in the recent past (levy and Markowitz, 1979 ; Pulley, 1981, 1983 ; Kroll, levy, and Markowitz,

1984 ; Reid and Tew, 1986). Recently specifically agricultural applications have been made (Tew and Reid, 1987 ; Tew, Rafsnider, Lybecker, and Chapman, 1986). One very desirable property of the technique is the elegant simplicity of calculations involved. A second is that the criterion only requires either that returns be normally distributed or a decision maker's utility function is quadratic.

The often suggested alternative is linear regression analysis. Its use was rejected first, because scaling techniques necessary to adjust the data introduce intractable errors in parameter estimates. Second, it is an approximation of first degree stochastic efficiency analysis which uses cumulative density functions. As a rule CDF's from the same or different families, tend to intersect at least once, thereby mitigating against the chance of identifying dominating strategies (Anderson, Dillon, and Haedaker, 1977).

V- RESULTS

The expected value-variance parameters for gross magrins, generates by on-farm experimentation and actually observed profitabilities for three classes of farmers are shown in Table 1. As can be seen average dirham profitability in

Table 1

Economic Performance Parameters for Two Varieties Experimental and Actual Farmer Soft Wheat Production Activities in Abda and Chaouia Regions in 1988-89
Crop year

Production Activities	Abda Region (Dhs/ha)		Chaouia Region	
	Mean of net revenue	Variance of net revenue	Mean of net revenue	Variance of net revenue
Experiments				
Nesma fertilized	1,295.80	1,016,362	1,729.36	1,838,753
Nesma unfertilized	1,944.58	845,140	1,756.84	1,416,563
Saada unfertilized	1,444.50	687,004	2,380.11	1,128,297
Saada fertilized	1,802.98	845,156	2,519.21	3,632,514
Actual Production *				
Small farmer	548.18	236,803	1,723.12	2,631,577
Medium farmer	729.17	1,369,868	1,874.36	2,783,851
Large farmer	685.09	754,619	3,330.91	2,468,020

* A small farmer operates less than ten hectares and does not own a tractor. A medium sized farmer operates ten to thirty hectares and does not own a tractor. A large farmer owns a tractor and operates 10 to 300 hectares.

Each region varies by 200 to 300 percent and up to 600 percent between regions. Variabilities are extremely large. Results of using the expected value-variance criteria (if two strategies have the same mean profitability the one with the lowest variance is preferred or if equal variances the one exhibiting higher mean profit) to identify the risk efficient set in each region appear in Table 2. Using these as proxies for research which may be conducted suggests :

Table 2
 Risk Efficient Soft Wheat Varietal and Production Activities
 in Abda and Chaouia Regions in 1988-89 Crop Year.

Regions and Activities	Economic Parameters (Dhs / ha)	
	Mean of net revenues	Variance of revenues
Abda Region		
Medium farmer	548.18	236.803
Saada unfertilized	1,444.50	687,004
Nesma fertilized	1,944.58	845,140
Chaouia Region		
Saada unfertilized	2,380.11	1,128,297
Large farmer	3,300.91	2,468,020

Two points. In Abda Region on-farm research conducted by small farmers yields results valid only for small farmers. Only small farmer activities appeared in the efficient set. In Chaouia Region, small farmer conducted research may be valid for large farmers since both were in the efficient set. Moreover, in neither region did the research address medium sized farmer needs.

VI- CONCLUSION

The research in Abda and Chaouia show that in 1988-89 the introductions of the SAADA Variety of soft wheat and nitrogen fertilizer are risk efficient in certain cases. This was demonstrated by results of risk analyses of data from the on-farm trials which were carried out. In the future, however, account must be taken of the farmers' marketing strategies. Most farmers plant bread wheat and sell it at the local souk, which necessitates having a product which meets consumer preferences for appearance and other performance criteria.

In stressful climatic conditions, it is not possible to pass final judgment, on these two innovations, based solely on economic performance registered during a single

cropping season. However, the expected value-variance criterion can be used to analyze results of on-farm trials and does provide information on research strategies by identifying those activities which are efficient economically and geographically.

Finally, it is suggested the risk efficiency criterion may be applied to identification of farming domains in which further research is useful.

RESUME

" L'utilisation du critère d'efficacité au risque" comme élément d'évaluation des essais chez les agriculteurs des zones Arides et Semi-Arides".

Ce travail vise l'application d'une nouvelle approche économique pour l'évaluation des innovations agricoles. Une telle approche repose sur l'utilisation du critère d'efficacité au risque (Risk efficiency criterion) pour identifier les technologies et leurs domaines d'utilisation et ce ci à travers la comparaison des variances issues des traitements.

Cette approche a été appliquée pour tester les performances économiques de deux techniques agronomiques qui sont une nouvelle dose qui est 60 unités et une nouvelle variété du blé tendre qui est Sâada.

A défaut du manque de base de comparaison, les informations sur les pratiques agricoles des agriculteurs de Abda issues de l'enquête (1986-87) et celles des agriculteurs de Chaouia (87/88) ont été actualisé pour servir de référentiel de base.

Les résultats ont montré :

- 1- L'application de la variété Sâada sans azote est efficiente au risque dans le cas des agriculteurs moyens.
- 2- La variété Nesma avec azote a été performante dans la région d'Abda.
- 3- Les techniques agricoles des agriculteurs moyens de Abda sont efficace au risque.
- 4- Les techniques agricoles des grands agriculteurs de Chaouia sont efficientes au risque.

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