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Agro-pastoral production system of Egypt. Climate change, vulnerability and opportunities for poverty alleviation

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Abstract. Agro-pastoral production system in the northwestern coastal zone of Egypt is characterized by varied agricultural activities including raising small ruminant's flocks, beside cultivation of barley and some fruits as Olives and Figs. This system has been fragilized by drought that has become more frequent and worsened by human activities. A survey study was conducted to identify and analyze the causes, impacts and management mechanisms of drought crisis in this area. The sample of the study encompassed 162 agro-pastoralists. Major findings were extracted for the causes of drought vulnerability included socio- economic, livelihood and agriculture. The annual income of the household reduced by 58.3% in the drought years. The various Bedouins coping mechanisms were inadequate to reduce the negative impact of drought. Results highlight small ruminant role on alleviating poverty and helping household to deal with climate variability. The share of small ruminant in the households economy in the dry year ranged from 60%-67%.The perception of small ruminant to escape poverty is completely linked to the flock size. Based on the findings and conclusions of this study, specific recommendations were made to reduce effects of drought crisis.

Keywords. Agro-pastoral system – Survey – Drought vulnerability – Small ruminants – Poverty alleviation.

Système de production agro-pastorale de l'Egypte. Changements climatiques, la vulnérabilité et les possibilités de réduction de la pauvreté

Résumé. *Le système de production agro-pastorale dans la zone nord-ouest de la côte de l'Egypte se caractérise par diverses activités agricoles, y compris élevage des petits troupeaux ruminants, à côté de la culture de l'orge et certains fruits comme les olives et les figues. Ce système a été fragilisé par la sécheresse qui est devenue plus fréquente et aggravée par les activités humaines. Une enquête a été menée afin d'identifier et d'analyser les causes, les impacts et les mécanismes de gestion de crise de la sécheresse dans ce domaine. L'échantillon de l'étude comprenait 162 agro-pasteurs. Les principales conclusions ont été extraites pour les causes de la vulnérabilité à la sécheresse inclus socio-économique, moyens de subsistance et l'agriculture. Les résultats mettent en évidence le rôle des animaux du ferme sur la réduction de la pauvreté et pour aider les éleveurs à faire face à la variabilité du climat. La perception de l'élevage pour échapper à la pauvreté est complètement liée à la taille du troupeau. Sur la base des constatations et des conclusions de cette étude, des recommandations spécifiques ont été faites pour réduire les effets de crise de la sécheresse.*

Mots-clés. *Système agro-pastoral – Enquête – Vulnérabilité à la sécheresse – Petits ruminants – Réduction de la pauvreté.*

I – Introduction

Egypt has poor rangelands, although vast areas of more than 10 million ha exist. According to FAO (2010) rangelands provide only 5 percent of animal feed in Egypt. Hegazi *et al*. (2005) indicate that the main areas of rangelands are distributed over the northwestern coastal zone (NWCZ), the Sinai Peninsula and the Halayeb- Shalatyin region in the South East corner of Egypt bordering the Red Sea. The NWCZ is characterized by low rainfall (<150mm) and high fluctua-

tion of the precipitation. Pastoralists and agro-pastoralists are the dominant economic activity. Economic survival of the peoples of the region depends on management of sheep and goats, beside cultivation of barley and some fruits as Olives and Figs. The zone has witnessed major changes over the last 50 years; demographic growth, urbanization and touristic development. More recently, the zone has faced a long drought period from 1995 to 2011 that has negatively affected rangelands, agriculture, livestock production and household livelihood. An understanding of the socio-economic impact of drought and of farmers' coping mechanisms is essential in designing technological and policy interventions for more effective drought mitigation. This study was initiated to identify and analyze the causes, impacts and management mechanisms of drought crisis in this area. It also contrasts how Bedouins poor in livestock (BPL) fared compared to those wealthy in livestock (BWL).

II – Material and methods

The survey was conducted by way of personal interviewers with 162 agro-pastoralists covering three districts (Matrough, Neguila and Sidi barani). The survey was carried out over a period of two years (February 2008 to August 2010) using structure questionnaires contain a total of 90 items, grouped into Bedouins production resources, their production constrains, management practices, input and output parameters, small ruminant and agriculture production performances.

Whole farm budget was performed using Microsoft Excel spreadsheet to estimate economic losses due to drought at the Bedouins level. Families were stratified into two categories according to flock size. The gross margin is estimated for each of farm activities as the difference between total revenue and total variable costs. The costs and benefits were converted into monetary terms using farm gate prices. Least squares analyses of variance were conducted using the general linear model procedure of SAS (1990). Statistical model included drought, flock size and drought –flock size interaction. Three Bedouins coping mechanisms were relied to reduce the negative impact of drought, namely; 1- decreasing flock size, 2-selling their lambs and kids after weaning directly and 3 - move with their flocks searching for feed. Simulation techniques were used to apply the various scenarios on farm models. The model was a modified version of the Texas A &M sheep simulation model (Blackburn and Cartwright, 1987a, b, c). Detailed description of the simulation model is presented in Almahdy and Metawi (2000). Small ruminant flocks were simulated for 10 yr life-cycle production.

III – Results and discussion

Drought produces a large number of impacts that affects the social and economic standard of living. Analysis of data showed that the drop in agricultural income during a drought year was in the range of 40-80 per cent of average rainfall -year income. The effects of drought on the flock size changes and flock performance for (BWL) compared to (BPL) are presented in (Table 1). The average flock size and annual sheep and goat productivity were declined by only 12.9%, 3.2% and 4%, respectively for the (BWL). On the other hand, the drought under (BPL) conditions has leaded to reduce of sheep and goat flocks' productivity by 23.4 and 16%, respectively. Furthermore, their average flock sizes were reduced by around 47% which reflecting that sheep and goat are important physical assets, which can be liquidated at times of financial need.

Although the financial analysis of sheep and goat production gave positive return, drought greatly affected its profitability. The share of small ruminants in the household's economy in the average rainfall year were estimated as 43.6% and 47.7% among (BWL) and (BPL), respectively. The corresponding figures in the dry year were estimated as 59.8% and 67%,respectively. Shomo (2004) reported that sheep are the principal economic activity in the dry areas, contributing 57-89% of the income of small scale producers.

Table 1. The effects of drought on small ruminant flock performance

Characters	Average year		Dry year		F-test		
	BWL	BPL	BWL	BPL	D	FS	D×FS
Flock size, head	225	48.9	196	26			
Source of income:							
Crop cultivation,%	22.6	15.8	4.0	1.3			
Fruits:							
Olive,%	8.3	6.2	5.9	2.0			
Fig,%	13.9	8.4	9.8	2.8			
Small ruminants,%	43.6	47.7	59.8	67.0			
Non-farm income,%	11.6	21.9	20.5	26.9			
Productivity:							
Sheep[1]	28.2	26.5	27.3	20.3	×	NS	××
Goats[2]	19.9	18.7	19.1	15.7	NS	NS	×
Financial analysis:							
Profit / ewe, LE[3]	428	465	135	160	××	×	×
Profit / doe, LE	227	250	70	96	××	NS	×

1 = Kg lambs production/ewe/year; 2 = kg kids production/doe/year; 3 = $ = LE5.8; D = drought; FS = flock size; × $p<0.01$; ×× $p<0.001$; NS = non significant.

The frequent occurrence of drought results in widening the gap between the feed supply and nutrient requirements of small ruminants. The main expenses are due to the feeding when supplements are used. In addition to severe stressors like crop failures and unemployment makes (BPL) more sensitive to droughts. The annual income of the household reduced by 58.3% in the drought years. Bedouins attempted to compensate this loss by seeking additional employment in the non-farm sector. This additional income, however, was compensating the loss in farm income by only 9-16%. Bedouins relied on three main mechanisms to recoup this income loss: decreasing flock size, selling their lambs and kids after weaning directly (58% of the breeders), and move with their flocks searching for feed. Two types of movements are observed in the region i.e. within and outside the region. In average rainfall years the within movements are observed where sheep and goats move from dry areas to wet areas where natural vegetation is available. In dry years, however, flocks of sheep and goats move to adjacent provinces(e.g. Alexandria, Behaira and Fayoum) where irrigated fodder and crop residues are available.. These adjustments helped recover 19- 28% per cent of the total loss in income. Households still ended up with more than 50 per cent lower income than in a normal year, despite all these adjustments. Thus the various Bedouins coping mechanisms were inadequate to prevent a shortfall in income. Therefore, Bedouins make adjustment in their expenditure items of his budget to reduce the negative impact of drought. Household budget in an average rainfall year was spent purchase of food (36%), followed by clothing (16%), school fees (14%), medical expenses (10%), social activities (7%), and other items (17%). On the other hand, income in a drought year was spent mostly on purchase of food 78%. However, Egyptian government also intervenes to assist Bedouins, through:

(i) Distribution of subsidized feedstuffs or subsidized loans to buy feedstuffs. The objective to help smallholders to improve animal productivity and to get additional revenue through lamb and kids fattening activity.

(ii) Investments in digging of wells, cisterns and water harvesting systems.

(iii) Distributed of Damascus bucks as a tool for goat genetic improvement. The main advantages of the Damascus crossbreds were reported by Aboul-Naga *et al*., 2008.

IV – Conclusion

It can be concluded that, the various Bedouins coping mechanisms were inadequate to reduce the negative impact of drought. On the other hand, the share of small ruminants in the household's economy in the in the dry year were ranged from 60% to 67%. So, improving small ruminant production systems can make a significant contribution to reduce the negative impact of drought. The challenge is to develop mechanisms to provide poor Bedouins with feedstuffs and Damascus goat bucks either through credit loans or through livestock breeders associations. Also, reducing animal feed cost by enhancing crop byproducts nutritive value is more recommended during drought periods. However, there are many different kinds of agro-industrial byproducts available in the region, which is seriously under exploited. Investment in rural education can increase return to labour as well as help diversify income. Using poor quality underground water and drip irrigation system is considered in drought years.

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