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Impact of drought on livestock productivity in Morocco

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SUMMARY – The objectives of this study were to determine drought impact on livestock systems and their productivity in the Northern Central Region of Morocco. Data were analyzed according to three Drought Indicators related to Livestock Productivity. Pertinent Drought Indicators are represented by forage yields and animal prices, which decreased with drought, and feed prices which increased in dry years. Fairly pertinent Drought Indicators are represented by flock size and fattened livestock prices which decreased in dry years. Poorly pertinent Drought Indicators, represented by the number of slaughtered animals, were not analyzed because of lack of data. The feed and cereal yields decreased in dry years, whereas purchased feed quantity increased with drought severity. The duration of supplementation increased from 3 months in humid years to 12 months in dry years. Fecundity, fertility and numerical productivity rate decreased during dry years. Mortality rate was 16% in dry years versus 6% in humid years.

Key words: Drought, livestock systems, productivity, Morocco.

RESUME – *"Impact de la sécheresse sur la productivité de l'élevage au Maroc". Les objectifs de cette étude sont de déterminer l'impact de la sécheresse sur les systèmes d'élevage et leur productivité dans la région Nord Centre du Maroc. Trois indicateurs de sécheresse ont été retenus. Les indicateurs pertinents sont représentés par le rendement des fourrages et les prix des animaux qui ont diminué avec la sécheresse et les prix des aliments du bétail qui ont augmenté en année sèche. Les indicateurs moyennement pertinents sont représentés par les effectifs des animaux et les prix des animaux engraissés qui ont diminué en année sèche. Les indicateurs peu pertinents n'ont pas été analysés par manque de données. Les rendements des céréales et fourrages ainsi que les taux de fécondité, de fertilité, et de productivité numérique ont diminué avec la sécheresse, alors que les quantités d'aliments pour bétail achetées, la durée de supplémentation, et le taux de mortalité ont augmenté avec la sécheresse.*

Mots-clés : *Sécheresse, systèmes d'élevage, productivité, Maroc.*

Introduction

Climate in Morocco is characterized by irregular rainfall and frequent dry years: 1 dry year each two years during the nineties decade. Thus drought is considered in Morocco as a structural problem leading to considerable losses (Mokssit and El Khatri, 2001). Cereals production decreased from 9.6 M tons in 1993/94 (humid year) to 1.74 M tons in 1994/95 (dry year) (Observatoire National de Sécheresse, 2000). Livestock losses reached 16 billions Dirhams during the last decade and feed deficit was 8 billions of FU (Blal, 2000). Drought also changed livestock systems from extensive based on pasture to semi intensive based on supplementation (Keli, 2002; Mourid, 2001). The objectives of this study are to investigate the changes induced by drought on livestock systems and to evaluate the impact of drought on livestock productivity.

Material and methods

This study was carried out in the Northern Central Region of Morocco (Sais) which is characterized by rainfed agriculture and the importance of cereals and livestock. Data were collected from the Ministry of Agriculture Services from 1995 to 2003. The data collected concerned precipitation, cereals and forage yields, livestock herd size and feed prices, and the quantity of slaughtered meat. The studied years (1995-2003) were classified according to drought: (i) Humid (H): 95/96 and 02/03; (ii) Moderately Humid (MH):96/97 and 97/98; (iii) Moderately Dry (MD): 2000/01; and (iv) Severely Dry (SD): 98/99, 99/00 and 01/02. In order to investigate drought impact on livestock systems and their productivity, 130 breeders were selected in the studied area according to land, livestock ownership, and breeder's cooperation. Data concerning agricultural area, flock size, feeding calendar, sanitary

measures, animal sales, livestock and crops production, were collected by a questionnaire from April to June 2004. The study years 2000-2004 were classified according to drought: (i) Moderately dry: 2000/01; (ii) Severely dry: 2001/02; and (iii) Humid: 2002/03 and 2003/04.

Results and discussion

Impact of drought at the regional level (SAIS)

Data were analyzed according to three Drought Indicators related to Livestock Productivity:

(i) Pertinent indicators represented by forage production; livestock prices; feed prices.

(ii) Moderately pertinent indicators represented by price of fattened animals; livestock herd size.

(iii) Poorly pertinent indicators represented by the number of slaughtered animals.

Pertinent indicators

The results show that all pertinent indicators varied according to drought severity. Forage production (Fig. 1) as well as ewes and cows prices (Figs. 6, 7) decreased considerably during dry years, whereas the prices of barley (Fig. 2) straw (Fig. 3) bran (Fig. 4) and dry beet pulp (Fig. 5) increased during dry years.

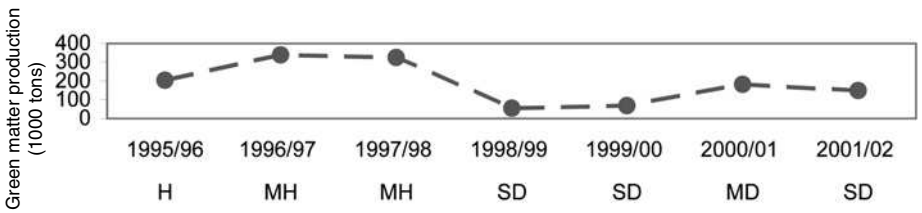

Fig. 1. Forage production as affected by drought.

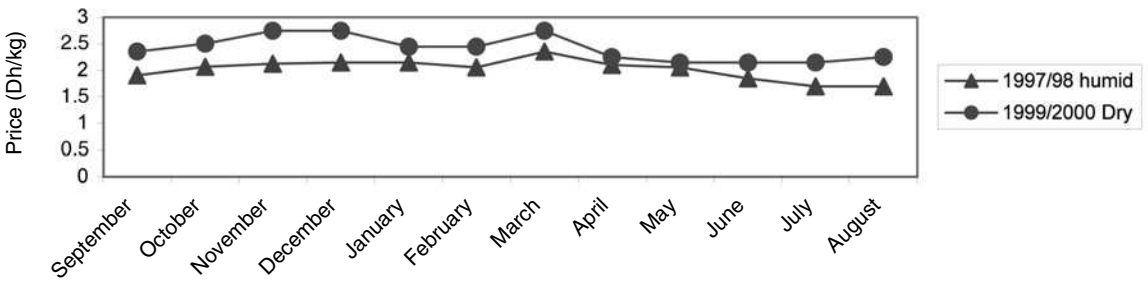

Fig. 2. Barley prices evolution (Dh/kg) during a humid year and a dry year.

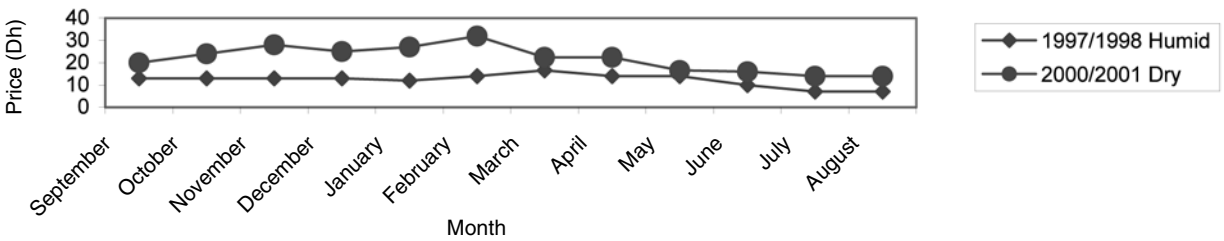

Fig. 3. Straw prices evolution during a humid year and a dry year.

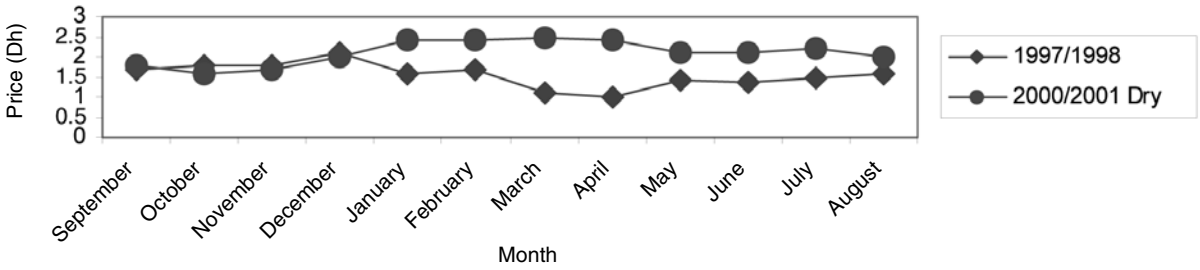

Fig. 4. Comparison of bran prices during a humid year and a dry year.

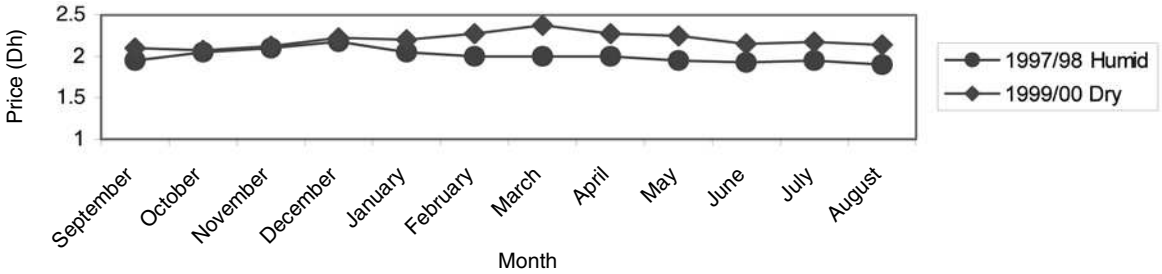

Fig. 5. Dry beet pulp prices evolution during a humid year and a dry year.

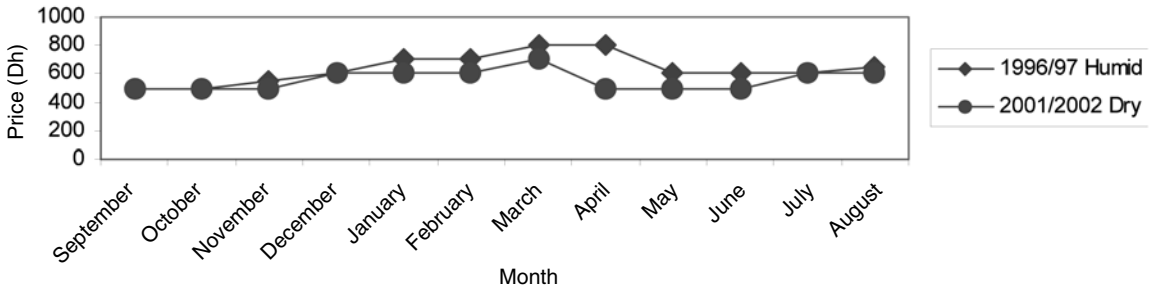

Fig. 6. Ewe price evolution during a humid year and a dry year.

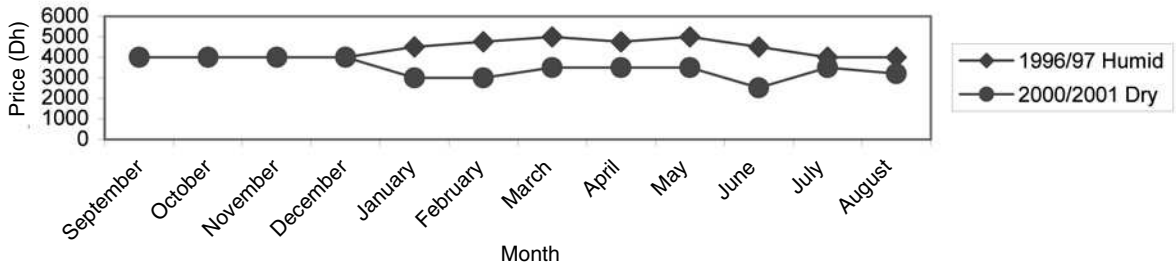

Fig. 7. Cow price evolution during a humid year and a dry year.

Moderately pertinent indicators

Concerning moderately pertinent indicators, fattened lamb and calves evolutions (Figs 8 and 9) shows the same trend during humid and dry years. This can be explained by the fact that all the feed used is purchased and not produced by breeders. However the prices were higher during a humid year because feed is more available and fewer animals are fattened. Herd size evolution (Fig. 10)

was also slightly affected by drought. Bouslikhane *et al.* (2001) also showed that moderately pertinent indicators are slightly affected by drought.

Poorly pertinent indicators represented by the number of slaughtered animals were not analyzed because of lack of data.

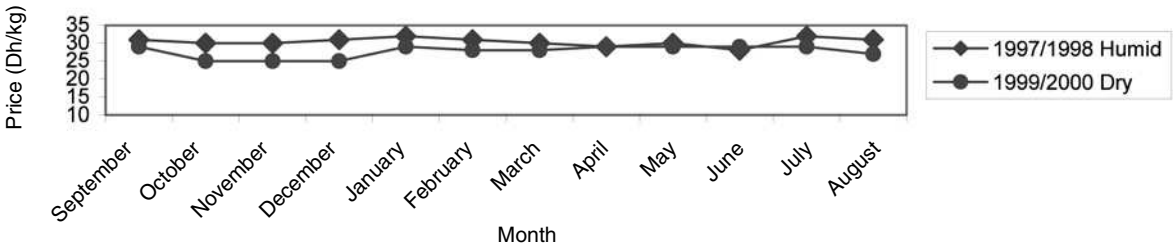

Fig. 8. Fattened lamb prices evolution during a humid and a dry year.

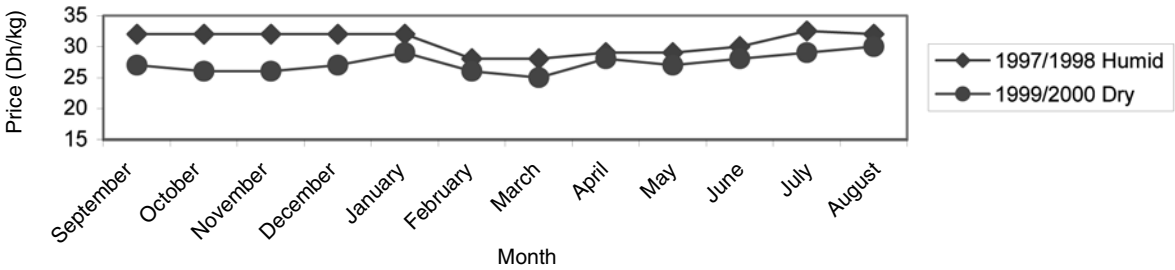

Fig. 9. Comparison of fattened calves prices during a humid and a dry year.

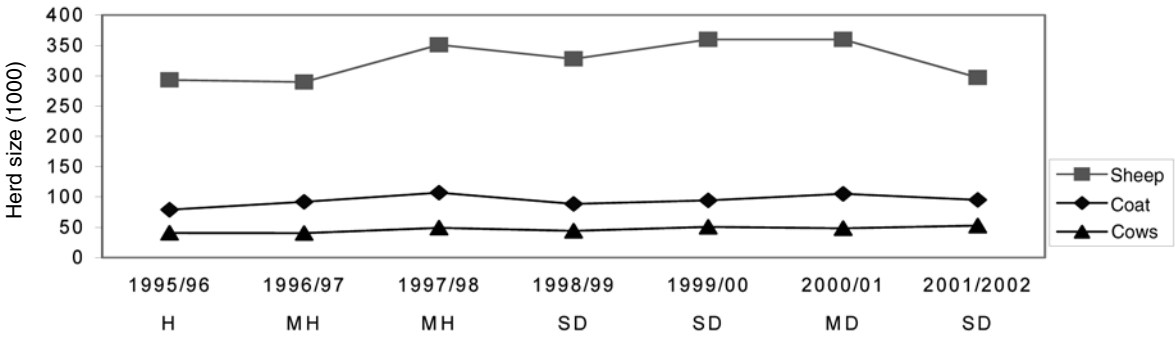

Fig. 10. Herd size evolution from 1995 to 2002.

Impact of drought on cereals yields

Although cereals yields are very affected by drought (Fig. 11), they were not considered as indicators because cereals yields estimation is not available until the effects of drought are already visible. The low yield observed in droughty years is the result of water stress during the growing cycle of crops

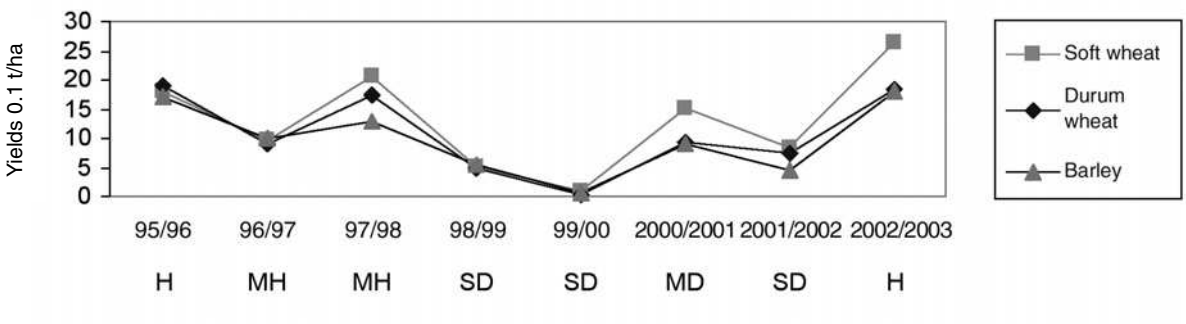

Fig. 11. Cereals yields as affected by drought.

Impact of drought on livestock systems and productivity: Breeders investigations

Cereals straw, oat-vetch and bitter vetch yields were very affected by drought (Table 1). The highest yields were obtained during humid years whereas the lowest were obtained in dry years.

Table 1. Impact of drought on cereals and forage yields (t/ha)

Crop	00-01 (MD)†	01-02 (SD)†		02-03 (H)†		03-04 (H)†	
	Yield (t/ha)	Yield (t/ha)	AVR (%)	Yield (t/ha)	AVR (%)	Yield (t/ha)	AVR (%)
Cereals grain	0.8	0.7	-11.6	1.4	93.6	1.5	8.0
Cereals straw	4.4	3.6	-17.9	6.4	78.5	6.6	3.1
Oat-vetch	4.33	4.04	-6.69	6.69	65.59	6.33	-5.38
Bitter vetch	0.39	0.26	-14.9	0.58	119.4	0.60	3.81

† MD = moderately dry; SD = severely dry; H = Humid; AVR = Annual variation rate.

Table 2 shows that the lowest quantity of feed was produced in dry years. Inversely the amount of purchased feed increased in severely dry years

Table 2. Impact of drought on feed supplement origin

Feed origin	00-01 (MD)†	01-02 (SD)†		02-03 (H)†		03-04 (H)†	
	Tons	Tons	AVR (%)	Tons	AVR (%)	Tons	AVR (%)
Produced	2053	1611	-21.55	2947	82.94	3094	4.98
Purchased	1782	2002	12.35	1052	-47.42	784	-25.53

† MD = moderately dry; SD = severely dry; H = Humid; AVR = Annual variation rate.

Sheep, goats, and cattle feed supplement varied according to drought severity: 3 months in a humid year (Fig. 12), 8 months in a moderately dry year (Fig. 13) and 12 months in a severely dry year (Fig. 14). Keli (2002) and Abrigache (2003) obtained the same results. The increase in feed supplement duration can be explained by the lower contribution of pasture, fallow and stubbles during drought. The previous figures show that drought modified livestock systems from extensive based on pasture fallow and stubble to intensive based on feed supplement.

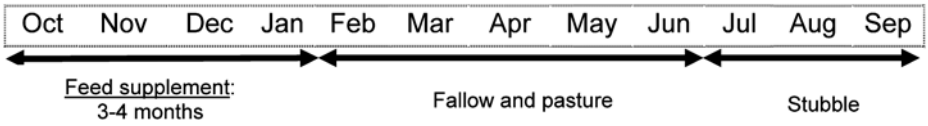

Fig. 12. Impact of drought on the feeding calendar during a humid year (2002-03 and 2003-04).

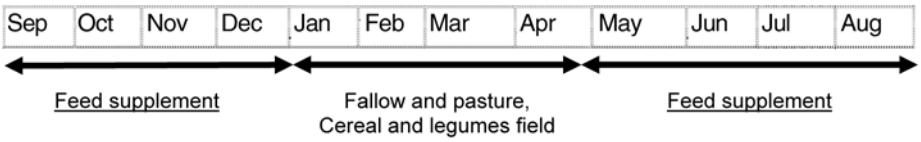

Fig. 13. Impact of drought on feed calendar during a moderately dry year (2000-2001).

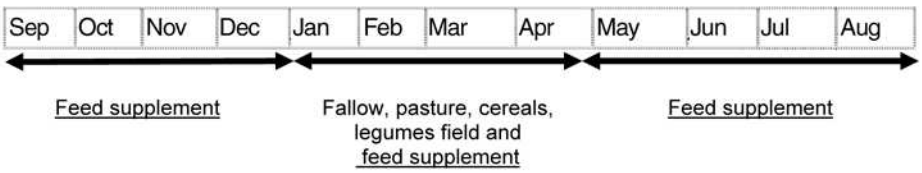

Fig. 14. Impact of drought on the feeding calendar during a severely dry year (2001-02).

The impact of drought on the reproduction and productivity parameters was statistically significant for sheep and goat (Tables 3 and 4). Fertility, fecundity and prolificity rates as well as numerical productivity decreased in severely dry years (Tables 3 and 4). The decrease of the previous parameters can be explained by malnutrition during the breeding season and gestation (Kabbali and Berger, 1990; Keli, 2002). Mortality and abortion rates increased with drought.

The impact of drought on cattle productivity was not assessed because most cattle herds are conducted in irrigated area.

Table 3. Impact of drought on sheep productivity

Parameters	Moderately dry 00-01	Severely dry 01-02	Humid 02-03	Humid 03-04
Number	1173.00	1083.00	983.00	1056.00
Fertility rate	82.30	83.40	86.80	88.10
Fecundity rate	87.60	89.25	92.94	93.99
Prolificacy rate	106.44	107.02	107.07	106.68
Numerical productivity	73.90	73.10	84.30	85.80
Abortion rate	3.90	4.20	2.20	1.90
Animals sales	45.6	47.9	38.2	36.6
Reform	7.90	8.40	4.13	4.24
Mortality rate (young)	13.93	15.98	6.80	6.20
Mortality rate (adults)	4.59	6.12	3.84	3.87

Table 4. Impact of drought on goat productivity

Parameters	Moderately dry (00-01)	Severely dry (01-02)	Humid 02-03	Humid 03-04
Number	207.00	185.00	164.00	179.00
Fertility rate	73.50	74.40	76.10	79.80
Fecundity rate	78.72	80.28	82.42	87.18
Prolificacy	107.10	107.90	108.30	109.25
Numerical productivity	68.1	67.60	75.30	82.10
Abortion rate	6.50	7.20	4.10	3.93
Animals sales	42.23	43.8	35.05	35.04
Reform	7.80	8.84	4.01	3.67
Mortality rate (young)	11.30	14.10	5.50	4.70
Mortality rate (adults)	5.70	5.20	4.12	3.78

Conclusion

This study showed that drought induced a decrease of cereals and forage yields, sheep and goat flock size and reproduction performances as well as an increase of purchased feed, feed supplement duration, animal's sales, mortalities and reforms.

Based on these results, the suggested measures to reduce drought losses are:

(i) Identify reliable and early indicators of drought.

(ii) Improve the way to collect data related to drought indicators.

(iii) Feed supplement should be based on animals nutritional needs and not only drought severity.

(iv) Adapt flocks size to feed availability with a good management of forages supplies.

(v) Pastures improvement to reduce supplemental feeding charges.

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