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Livestock Farming Systems and Cattle Production Orientation in Eastern High Plains of Algeria, Cattle Farming System in Algerian Semi Arid Region

Lounis Semara ¹, Charefeddine Mouffok ^{2*} and Toufik Madani ³

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Abstract

This study was an attempt to devise productive orientations of cattle herds in eastern high plains of Algeria. In this regard, 165 farms randomly identified were investigated. The selection of breeders was based to existence of cattle on the farm, and the farmer proposed to investigation must have at least two cows. The approach taken was to identify all systems adopted by farmers in a region through the analysis of the relationship between the maintenance of different types of cattle and preferred marketing policies. The model has been emerged as a result of functional typology established using the procedure categorical principal components analysis (CATPCA) of optimal coding in SPSS [19. 2010]. Following this approach, five types of cattle productive orientation have been identified, the balanced mixed system (dairy-beef), beef mixed system, dairy mixed system, dairy system and beef system. These results showed that the breeders were oriented towards specialization (dairy or beef) in less than 20% of situations. Farmers in our context prefer mixed systems when beef mixed system was the model type frequently encountered in the region (over than 50% of farms).

Keywords:

Livestock, typology, Farming system, Cattle, Management

¹ Ph.D Student of Animal Production, Department of Agriculture and Animal Science, Setif 1 University, Algeria.

² Assistant Professor, Department of Agriculture and Animal Science, Setif 1 University, Algeria.

³ Professor, Department of Agriculture and Animal Science, Setif 1 University, Algeria.

* Corresponding author's email: mouffokcharefeddine@yahoo.fr

INTRODUCTION

Livestock and their products provide direct cash income and the animals are living the assets for many farmers (FAO/ILRI, 1995). Breeding cattle assume also the roles of job creation and income very important for social stability (Srairi *et al.*, 2009). In Algeria, animal production especially dairy cattle were always at the center of occupation of public authorities, well as several policies and actions have been applied. However, the dairy industry operates almost with imported powdered milk where 60% of milk requirements are imported. Several researchers have attempted to explain the poor performance of the cattle sector in the Algerian context by a constraint which opposes the development of a strong dairy activity, in particular, problems of adaptation of exotic breeds in different agro-ecological zones of countries (Madani and Mouffok, 2008) and the lack of fodder production required for intensive dairy farm.

Researches on livestock have always been guided by the search for efficiency improvement activity (Dedieu, 2009). Madani and Mouffok (2008), provide that the deficiency of milk production in Algerian's farms requires changes in technical choices and especially the type of animals and livestock systems implanted. Systemic vision on cattle farms prospecting is therefore essential to understand better the factors influencing the elaboration of performances. Many authors suggest two conceptual approaches, one focused on the analysis of farmers' practices, it comes to technical, economic and social farmers practical (Chapman *et*

al., 2008; Dufumier, 1996) and the other attempts to understand how farmers make their decisions (Shalloo *et al.*, 2004).

This research can be considered as a contribution to characterization diversity of cattle farming systems. Its aims through the adjustment of some technical and economic practices in of Algerian Eastern high plains farms to analyze the organization of cattle production systems and identify pathways to explain management and planning strategies adopted.

MATERIALS AND METHODS

Methodological approach

Investigation in a single passage was conducted among farmers and herders of cattle. Selection of farmers' was based on existence of cattle breeding activities and farm proposed for investigation must have at least two cows. In study region, these categories of farms correspond to plus than 90% of all breeders. In this regard, a sample of 165 farms were randomly chosen and visited. Livestock farms that are the subject of our investigation were located in two provinces of the eastern high plains of Algeria, Setif and Bordj Bou Arrerdj departments (Figure 1).

We also selected scale of aridity gradient which increases from north to south. The investigations have been developed in a questionnaire consisting of three components (socio economics of farmers family, structure and resources of farms and functioning practices of cattle herd) with more than 150 questions. The objective of this survey was to collect among those surveyed as much information about the livestock, but

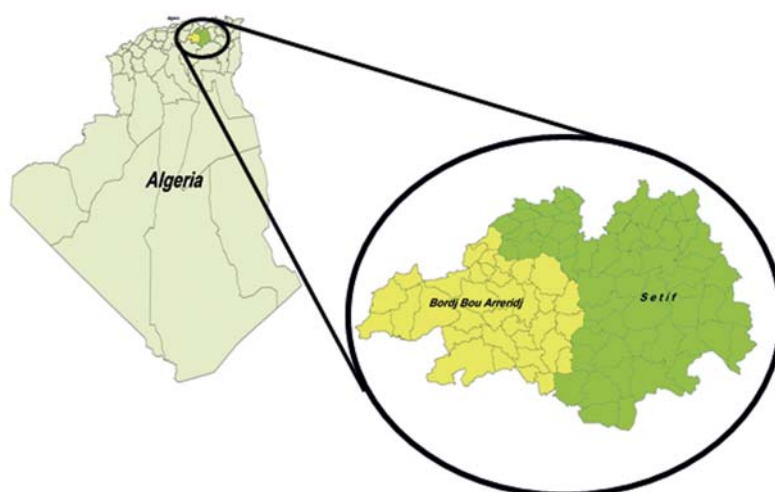


Figure 1: Localisation of studied area

Table 1: Data of cattle categories number in all farms'

| | Cattle (LU) | Cows | Heifer | Beef | Male Calf | Femelle Calf |
|-------------------------------|-------------|-------|--------|-------|-----------|--------------|
| Mean | 12.63 | 7.69 | 2.53 | 1.53 | 2.02 | 2.13 |
| Standard error of mean | 0.78 | 0.46 | 0.22 | 0.32 | 0.20 | 0.17 |
| Standard deviation | 10.00 | 5.49 | 2.80 | 4.01 | 2.55 | 2.10 |
| Minimum | 02.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Maximum | 71.45 | 45.00 | 14.00 | 40.00 | 18.00 | 10.00 |

LU : Livestock Unit

also variables related to the production environment and the diversity of functioning practices of cattle and strategies developed.

Diagnostics tools

A graphics typology was established using Categorical Principal Components Analysis (CATPCA) optimal coding procedure of SPSS (19.2010) software. This procedure was most appropriate to research aims to analysis the relationship between quantitative variables describing the structure of cattle herd (dairy cows effective, beef cattle effective, heifers effective, effective male and female calves) and the different modalities of qualitative variables describing practice-policies adopted by farmers such as type de breeding choice and cattle product commercialization (amount of sold milk and calves sale age). This categorization was reinforced by two-step cluster automatic classification procedure. All variables was presented by means and standard deviation.

RESULTS

Overall characteristics of farms

Effective and structure of cattle herd

The descriptive analysis of cattle herd size by farm was summarized in table 1. Results show that all farms exploit average herd of 12.6 ± 10.0 LU. The number of cows was 7.6 ± 5.4 by farm and this category represents more than 60% of the total cattle population. Those farms mark the permanent presence of 2.5 ± 2.80 heifers' and 1.5 ± 4.0 young beef. A large standard deviation recorded reflects a high divergence in the compositional structure of cattle herd between farms, which was the first indicator of the diversity of cattle production policies.

Description of economic practices

Theses farms were mostly cattle farms alone (46.7%) or cattle-sheep (41.8%). The association of cattle-sheep-goat was observed in less than 5% of cases and about 6.7% producers have developed a new trend to the association

Table 2: Farming system and economic practices of farms

| Variable | Modality | Percentage (%) |
|-------------------------|---------------|----------------|
| Breeding species | C.S.G | 4.8 |
| | C.S | 41.8 |
| | C.P | 6.7 |
| | C | 46.7 |
| Milk soled | Total | 45.4 |
| | Part of | 49.7 |
| | Never | 4.9 |
| Age of calf sale | Pre weaning | 12.5 |
| | After weaning | 13.5 |
| | Old age | 64.4 |
| | As needed | 10.0 |

C : Cattle ; S : Sheep ; G : Gaot ; P : Poultry.

Table 3: Model parameters' of CATPCA

| Dimension | Alpha of Cronbach | Proper Value | Explain variance |
|--------------|--------------------|-------------------|--------------------|
| 1 | 0.691 | 2.52 | 31.55 |
| 2 | 0.409 | 1.55 | 19.42 |
| Total | 0.809 ^a | 3.41 ^b | 42.67 ^b |

a. The total value of Alpha of Cronbach is based on the total proper value

b. Due to the presence of multiple nominal variables, the proper value and the total percentage of explained variance does not correspond to the sum on the dimensions

of cattle with intensive poultry production.

The analysis of economic practice (Table 2) shows that 45.4% and 49.7% of farmers commercialize respectively all or part of milk produced in the local and regional market and only 4.9% of producers refuse the sale of milk. Therefore, a large part of farmers surveyed (64.4%) announce that calves were sold at later age (more than one year of age). Therefore, about 12.5% of farms visited declare that the sale of male calves was programmed early before weaning and 13.5% of cases a marketing of male calves were done shortly after their weaning. In addition, 10% of producers using calves as saving money to mobilize when their economic needs (selling as needed).

Multivariate analysis

Statistical model presentation

Categorical Principal Components Analysis (CATPCA) was defined two axes with 43% of total variance. First axis represented about 32% of total variation. It was interpreted as an axis of dairy orientation. It was highly correlated to variables related to dairy activities such as number of cows' and heifers. The second axis explains 19% of total variation and was positively correlated to beef number and negatively correlated to dairy parameters' (Table 3).

Cattle farming systems identified

The approach adopted enhanced with two step classification has demonstrated five types of cattle system according to productive orientation of cattle herd (Figure 2 and table 4). The term "dairy farms" includes different levels of orientation, development and integration of milk production.

Type 1. Dairy system

Cattle breeders in this system (about 15% of all farms visited) prefer to exploit the potential

of animals in dairy production. The principal concern of these farmers was the commercialization of all milk produced on their farms in order to ensure highest possible income. Male calves born on the farms were for this category of breeders a co-product that gets rid rapidly before their weaning. Livestock is mostly specialized (cattle alone) or associated with intensified production of poultry. Animal material is formed by a lower size of herd (10 ± 8.5 LU/farm) characterized by a large dominance of cattle (over 90%). The milk production was ensured by the presence of 7 ± 6 dairy cows.

Type 2. Dairy mixed system (Dairy-beef cattle oriented milk)

This type covers about 20% of cattle farms in the region. In this livestock system, farmers adopt strategies of mixed cattle production but producing and sales milk was their essential income. The fattening of theirs calves was an unplanned act used to cope with economic uncertainties (sale of calves according to the economic needs). The livestock exploited was in order of 17 ± 12 LU. Cattle alone breeding mark this type of farms in 65 % of situation and cattle herd represents more than 80% of all exploited ruminants. This system promotes the highest number of dairy cows (10 ± 8) and a low number of beef (1.2 ± 1.3) per farms' due to sold of calves at an early age.

Type 3. Balanced mixed system (Dairy and beef cattle)

It was recorded in only 4% of total farms surveyed. In this first model, the cattle complete two different functions, complementary and reasonably balanced, milk and beef production. This system represents a small sample which are generally a large farms distinguished by prac-

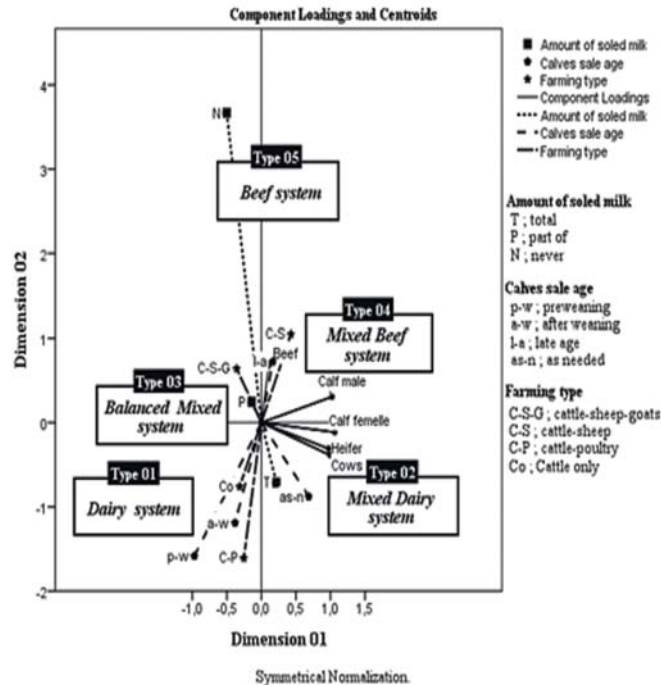


Figure 2: Graphical presentation of obtained model

tices of the partial marketing of milk and early sale of male calves. These farms do not give special attention to the type of production compared to the other due to large diversification of crops and livestock offered a multiple returns. In this regard, livestock herd was important (18.5 LU/farm in average) marks the breeding of fifty ewes and about ten goats near the cattle herd. Cattle represents about 50 % of all animals exploited characterized by the presence of 6.14±3.02 cows and 1.57±0.98 beef per farm.

Type 4. Beef Mixed System (Dairy-beef cattle oriented beef)

This system dominates the study region and farms shown here make up the model fre-

quently found in the context of the eastern high plains of Algerian (more than 56% of farms). These farmers adopt policies of mixed cattle system but more directed to the beef production. Suckling calves was a priority in farming practices as far as farmers reasoning was based on the earnings of beef compared to milk. A ruminant livestock contains 18±13 LU per farm. Over 60% of breeders who belonging to this group combine the cattle with sheep, the rest of farmers exploits mostly cattle alone. Approximately 70 % of total livestock exploited per farm was formed by the cattle herd defined by the presence of 7.42±5.21 cows and 2.44 ±2.78 beef.

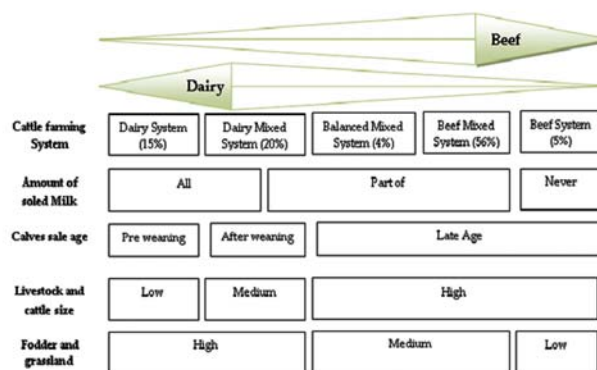


Figure 3: Characteristics of cattle farming systems'

Table 4: Characteristics of cattle farming system

| Variable | Modality | Cattle Farming System | | | | |
|--------------------------|-----------------------|-----------------------------------|--|--|---|------------------------------------|
| | | Type 1 Dairy system (14.5%) | Type 2 Dairy Mixed System (20.0%) | Type 3 Balanced Mixed System (4.2%) | Type 4 Beef Mixed System (56.4%) | Type 5 Beef System (4.8%) |
| Land | Arable Land | 24.7 ±23.9 | 23.6 ±29.9 | 41.5 ±71.9 | 23.9 ±33.2 | 11.9 ±9.9 |
| Fodder production | Fodder land | 2.2 ±4.7 | 2.5 ±4.6 | 2.0 ±2.6 | 2.5 ±4.3 | 1.0 ±1.4 |
| | Grass land | 1.5 ±2.5 | 1.1 ±1.9 | 1.6 ±1.8 | 0.9 ±1.6 | 0.4 ±0.7 |
| Livestock | Livestock Unit | 10.4 ±8.6 | 17.2 ±12.1 | 18.3 ±6.0 | 18.0 ±13.2 | 19.4 ±23.7 |
| | Ewes (head) | 7.9 ±22.6 | 18.9 ±36.5 | 45.3 ±22.8 | 35.4 ±47.4 | 12.7 ±15.6 |
| | Goats (head) | 0.0 ±0.0 | 0.0±0.0 | 13.6±7.8 | 0.3 ±1.9 | 0.0 ±0.0 |
| Cattle | LU Cattle | 9.2 ±7.5 | 14.3 ±10.2 | 10.2 ±3.7 | 12.7 ±8.9 | 17.5 ±23.2 |
| | Cows (head) | 6.9 ±5.6 | 9.9 ±7.9 | 6.1 ±3.0 | 7.4 ±5.2 | 6.4 ±6.4 |
| | Beefs (head) | 0.8 ±1.2 | 1.2 ±1.3 | 1.9 ±1.4 | 3.0 ±2.6 | 5.7 ±13.9 |
| | Heifers (head) | 1.9 ±1.6 | 3.2 ±2.9 | 1.9 ±1.5 | 1.7 ±3.0 | 0.0 ±0.0 |
| | Calf Male | 0.8 ±0.9 | 1.6 ±1.7 | 1.6 ±1.0 | 2.4 ±2.8 | 2.9 ±4.9 |
| | Calf Femele | 1.4 ±1.7 | 2.1 ±1.9 | 2.0 ±1.0 | 2.5 ±2.3 | 1.0 ±2.1 |

LU: Livestock unit

Type 5. Beef system

This category of farms encountered with a low frequency (less than 5% of farmers) is similar to the model of suckle cattle system in temperate regions. If reproduction and fattening calves are the center of interest of policy makers on these farms, the milk can not be sold. It was valued in suckling of future beef. In these situations, ¾ breeders exploit in parallel sheep if were not specialized farmers (cattle only). It has a biggest animal herd (more than 19 LU). The cattle herd separately form more than 90% of the overall livestock distinguished operated by breeding 6.8 ± 6.4 cows and 5.7 ±13.9 beefs.

DISCUSSION

The study showed that more than 80% of farmers in the context of Algerian semi arid area adopt mixed cattle farming systems (Dairy-Beef). These producers operate in an unfavorable agricultural environment characterized by several economic and technical problems (instability of farm product price in the internal market and lack of technical backstopping). In this

particular environment where milk production is low and unfavorable to these constraints, the profitability of cattle livestock specializes in the production and marketing of milk is unsecured. Only the profits generated by the fattening of calves born on the farm can encourage these farmers to continue their activities. On these farms, lack areas of grassland and feeble forage production for various reason preventing farmers to achieve a satisfactory of intra-farm level of forage autonomy (Figure 3). In several situations, forest grazing or cereals residues are sources of food for herds which housed under these livestock systems. Such obstacles are pushing farmers logically to avoid the attachment of the productivity of theirs farms to a single product (milk or beef). In this condition maximizing production is a secondary goal after the survival of the farm (Abbas, 2004). However, in temperate countries with high predisposition to the specialization activities Chatellier and Jacquerie (2004) reported that 25% and 20% of farms respectively in Belgium and Austria are mixed (Dairy-Beef) due to various rea-

sons. In Tunisia, according to Jaoad (2004), a mixed dairy-beef systems can be observed in medium-sized farms. The reason for this is that beef production in combination with milk can be carried out with fewer animals than in beef production systems. Milk and beef production systems are closely connected and changes in milk production systems will cause alterations in beef production systems (Christel and Magnus, 2003).

The mixed system (Dairy-Beef) but more oriented towards beef production is the system model dominant cattle breeding in the study area (over 56%). Logical approach which these farmers have melted their policies are still economic profitability of beef production against milk and the efficiency of work organization in farms. Partial sale of milk guaranteed the coverage of life family expenses and daily cost of livestock activities, while the selling of beef and calves promotes the creation of funds using for new investment and modernization of farm. A difficulty of integration on milk collection networks and lack of milk conservation instruments in farms have also contributed in these policies. In France for example and according to a report established by Livestock Institute, meat produced comes in 35% from dairy cattle, and mixed and dairy farms supply 50% of young cattle for fattening.

The mixed system (Dairy-Beef) but more oriented towards the production of milk corresponds perfectly to farms "cattle alone". These farms sold all milk produced to the public or private dairies to benefit a subvention for milk production and other advantages. An important number of these farms were in mixed system (Dairy-Beef) oriented beef evolved gradually to Dairy-Beef system oriented milk in search of stability and consistency of income provided by the sale of milk at a price substantially improved over the last years. Jaouad (2004) report that in Tunisia mixed systems can be found in small-scale irrigated farming which is predominantly oriented to dairy production.

The dairy system can be encountered only in farms with cattle-sheep breeding dominated by cattle herds or in cattle-poultry farms. These specialized farms are rarely only cattle farms. The early sale of young males born on the farm

offers more facility in the sale of all milk produced by dairy cows. Farms structure factor is not to call into question but rather the search for stable sources of income that have guided this policy. In Morocco, the specialized dairy system was observed in large farms (Srairi and Kessab, 1998) or in irrigated perimeter smallholders' (Srairi et al., 2003) that 100% of arable land was used in fodder production. In this region only farms' directly committed to the way of specialization arrive at high economic performance.

In beef system, it was absolutely normal to accept that the sale of milk is never done on these farms for technical reasons relating to the valorization of milk producing in suckling of calves following the example suckling systems in temperate regions. However, cows' of local or cross breed in this environment are conducted in extensive on limited areas or without forage resources. It is reasonable also to assume that these practices are largely inflicted by traditional and socio cultural reasons. In Maghreb, the breeding of calves or beef fattening, are based on very limited areas (less than 5 ha) that much of the feed is purchased (Jemai and Saadani, 2000; Srairi et al., 2003).

CONCLUSION

Clearly, breeders in conditions of Algerian semi arid area prefer mixed systems. In cattle production strategies, it was the interaction of several factors that oriented breeders to favorite such system compared to the other. So it is logical to assimilate that the maximization of profits by reducing costs and optimizing production potential of herd, were the objectives of the breeder whatever manner with which it is organized. However, maximization of production per speculation was a secondary goal after the survival of the farm.

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