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# Socio-economic characteristics of agro-pastoralists in the Sahel region of Burkina Faso

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**ABSTRACT**

*Social and economic characteristics of agro-pastoralist were studied in two villages in the Sahel region of Burkina Faso. The objective was to contribute to a better decision taking in the fight against poverty in Burkina Faso, and its Sahelian region in particular. Single-pass surveys were conducted in 108 farms owned by agro pastoralists. In total six identified resources allow discrimination against producers. The power of discrimination of each of these resources has been evaluated and the results are given in order of relevancy: the number of sheep, goats, cattles, household size, number of donkeys and the number of poultry. The results on the typology of agro-pastoralists reveal that producers are heterogeneous in terms of provision of productive resources. Two classes of producers have been identified and classified according to the quantity of resources they possess. The main resources used in discrimination are: family labor, and (sheep, goat, cattle, donkeys, poultry) animal resources. Compared to the average of the sample averages of resources available to the two classes are statistically and significantly different. An agro-pastoralist class has resources below the confidence interval of the average sample. It has been described as poor and represents 82% of the sample. The second class has resources beyond the confidence interval of the mean of the sample (18% of the sample), and is described as rich. The poor are the most important strata in rural areas. Strategies and animal breeding practices and associated performance are strongly related to the level of resources. Indeed, the decision to adopt a technology depends not only on need and will of producers to changes, but also their ability to that change given the resources they have to generate the funds needed for investment in new production techniques.*

**Keywords**: *households, Breeder, Type, Socio-economics, Sahel, Burkina Faso*

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## INTRODUCTION

Burkina Faso economy is essentially based on agriculture and livestock, which absorbs more than 90% of the labor force and contributes 40% of GDP and about 55% of total exports. The economic growth rate between 1998 and 1999 was 5%. Despite these significant macro-economic performance, the study on the profile of poverty *conducted* in 1996 showed that 44.5% of the population lives below the poverty line estimated at 41 000 FCFA per adult per year on the basis of expenditure on basic needs [2]. The same study indicates that poverty is predominantly rural. Among the 44.5% of people considered poor nationally, only 7.8% concerns the two major cities (Ouagadougou and Bobo-Dioulasso), 18% in other cities, and 40 to 61% in rural areas. Sawadogo [6] estimate that 42% of the rural population live above the threshold of moderate poverty. These authors estimated the threshold of moderate poverty (2/3 of the average real income) equivalent to 59 kg grain per adult per month.

The gravity of the situation led the government in 1995 to develop a human development framework. The letter of intent for Sustainable Human Development (LPDHD) prepared for this purpose in collaboration with the United Nations Development Program (UNDP), places a priority on human development and is centered on accelerating

growth. The reduction of poverty appears as a consequence of a targeted growth occurring in sectors of intensive labor. The specifically targeted sector is agriculture, which employs about 80% of the population and is home to the majority of the poor. To accelerate economic growth, transformation of agriculture and livestock has been identified as one of the areas for targeted interventions [7].

Livestock constitutes an important source of economic growth and poverty reduction in rural areas. It contributes more than 10% of GDP. Although cattle breeding is practiced throughout the country, the intensity of this activity remains relatively variable from one region to another and this is in proportion with the diversity of agro-climatic and socio-economic conditions of the area. In this region, of cattle breeding tradition, the distinction between farmers and animal breeders tends to decrease. The search for greater security has driven people in rural areas to diversify their sources of income consisting of combining agricultural and pastoral activities within the same family production units. Agro-pastoralism is the norm, although some are dedicated preferentially to agriculture and other to animal husbandry.

In the Sahel region of Burkina Faso, the poverty data shows that the poverty profile is among the marked. According to Sawadogo [6] the incidence of poverty is higher in the central plateau (represented by the province of Namentenga) than in the Sahel (breeding area) or in the area of south-west (cotton zone). Thus, the Sahel is the second contribution to national poverty, with 32% coming after the central plateau which contributes to around 50%. As for the contribution of the south-west, it is estimated at 18%. The purpose of this article is to provide socio-economic benchmarks for better targeted actions and implementation of better mechanism for effective monitoring and evaluation of interventions in favor of agro-pastoralists

## MATERIALS AND METHODS

### Data collection

Data were collected in two villages north and south of Sahel Burkina. The villages were selected based on the following criteria: (1) farming is the dominant activity; (2) organizations are dynamic and (3) agro-ecological representativeness of villages. Two villages Aribinda North and South Pobé were investigated. A questionnaire was administered to 108 farmers in these two villages (50 in Arbinda and 58 in Pobé). The issues addressed in this questionnaire were: (1) identification of the producer, head of household, (2) identification of the household, (3) the activities implemented under the responsibility of the head of household (4) Animal Production (reproduction and physical productivity of milk) and vegetable production (speculation, productivity, etc..), (5) the composition of the household livestock (species, breed, herd structure, etc..), (6) the exploitation of herd (sale, purchase, etc..), (7) driving modes animals (health and nutrition) and (8) the need for technical innovations. Finally, the survey was conducted in a single pass.

### Data Analysis

The objective of the study was the characterization and classification of producers in the region, methods of dynamic cloud classification and discriminative analysis (SPSS 10 software) was used [5]. The classification cloud dynamics identifies relatively homogeneous groups of farmers on the basis of the pre-defined characteristics. For this study six characteristics (variables) of rural households were considered: household size, the number of cows, sheep, goats, poultry and donkeys. This choice has been guided by a first descriptive analysis on the entire sample. The procedure is based on an algorithm that can handle a large sample. One advantage of this procedure is that it can save the class to which each producer belongs. This allows the tracking of the socio-economic status changes of each producer after a developmental intervention. Comparable producers may be selected to test improved farming production technologies. Three classes of level productive resources were initially identified by this procedure.

Once the groups are formed, it is important to analyze the discriminative power of each feature. To do this, the classes of producers formed on the basis of dynamic cloud analysis are first re-examined through the descriptive statistics. The examination of the characteristics of the three basic classes, helped merge classes 2 and 3. The reason is that the third class had only one producer, relatively closer to the second class. Of the two choices that arise in such a situation (eradicate extreme or not), we opted to keep the producer. First, it is not far from the second class. Then, the size of the total sample is already relatively small.

Having decided to leave the class with a producer and merge it to the class to which it is closest, it was necessary to categorize the final two classes rich and poor. This class definition is based on statistical averages of the sample and the confidence interval of the average of the different characteristics considered. Producers whose average level of resources is less than the confidence interval of the sample mean are classified as poor. On the other hand are considered rich, producers whose average owned resources are greater than the confidence interval of the sample average.

Assessment of discrimination power characteristics considered was performed using discriminative analysis method. The discriminative analysis is useful for situations where you want to build a predictive model of group membership based on the characteristics of each individual. The procedure generates a discriminant function (or more if the number of group is greater than two) based on linear combinations of variables that provide the best discrimination between classes. The functions thus generated from a sample whose group membership is known, can be applied to new individuals with the characteristics considered but whose classes are unknown.

Finally, descriptive statistics were used throughout the data analysis for testing in some cases the equality of means and independence criteria. Data were analyzed using SPSS 11 software.

## RESULTS AND DISCUSSION

### Description of the surveyed households

*Ethnicity, education and community life*

The education, community and ethnic representation in the sample investigated is summarized in Table 1. The Fulce and Fulani represent the two major ethnic groups. They are followed by Bellah, Mossi and other minority ethnic groups (Rimaïbe and others). The illiteracy rate is about 41%. About 17% of households surveyed are literate in their native languages.

The school enrollment rate varies between the primary (23%) and secondary (35%). This gives an enrollment rate of the sample at about 58%. Finally, there is a strong community life in the region. The proportion of the surveyed population who are members of a socio-professional group is estimated at 82%.

*Dominant activities*

Two main types of activities are practiced by the surveyed population. Livestock production is an activity which occupies the majority of the rural population in the study area. It is classified as a major economic activity by 78% of households surveyed. However, agriculture and handcrafting activities are classified by 19% and 2% respectively. In practice, the surveyed households practice several activities with various intensity. Furthermore, the main activity that occupies most of their time is livestock combined with agriculture (56% of households) as a secondary activity. Producers who consider farming as their secondary activity represents 18% of the sample. Other side activities such as handcrafts (4%), trade (3%) exist in the study area. Similar results were reported by Kiema and Sanon [4] on the pastors of the same region. Finally, farmers practice more secondary activities such as agriculture, trade (11%), agriculture and livestock (1%) and livestock-trade (1%) with relatively the same intensity**.**

*Species and species of bred animals*

The livestock is characterized by a diversity of species and breeds. Indeed, livestock includes cattle, sheep and goats. Three breeds are high, but the local breed (zebu) is the most common, which is bred by 73% of households. However, there was the introduction of pure and cross alien race in 1% and 3% of the sample, respectively. For goats and sheep, 85% and 80% of the bred sample is the local breed (Mossi). Métis sheep are found in 3% of households against 1% for Métis goats. For monogastric species, producers (61%) raise only the local breed. The donkeys and camels local breed are not particular for breeding purpose but are used in traction when they exist.

In general, the animals were divided into single-species flock in 80% of cases. But there are also bi-specific herds (cattle, goats, sheep or cattle, sheep and goats) in 52% of cases. Finally, the tri-specific livestock (cattle, sheep and goats) are relatively less frequent (7% of households surveyed). The Percentages cannot total to 100% because of possible combinations of several options. For example, a producer may be a mono-specific herd cattle and bi-specific for sheep and goats.

*Types of habitats for animals*

Habitat types used for animals are varied (Table 2). The most common type of housing for cattle is pen and / or park (43%), followed by the shed (17%). About 9% of farmers keep their cattle in open air park, while 7% keep them outdoors. Finally, cattle are rarely kept tied to pegs. The same trends are observed for small ruminants; usually kept in pens and / or parks. Very few producers (3% of the sample) keep them in the open air. Monogastric animals are often kept in boxes for poultry (22%) and post for donkeys (15%). They are also kept under sheds in 13% of cases.

*Use of animal traction*

The use of animal traction is relatively well spread within households surveyed (67%). The use of donkey traction is the most common with 60% of households using it against 34% for the oxen. Animal traction is used with different equipment by the producers of the study area and that depending on the type of available traction.

Thus, animal traction is generally used by those who have to put the cart (30% of households) in the execution of field operations. It is rarely harnessed to the wagon for transport (1%). However, donkey traction is most often used in harnessed transportation (53%) and is rarely harnessed to the plow (6%). cows and donkeys are rarely used as a means of transport and are not harnessed to the chariots.

**Structural typology of rural agro-pastoralists**

*Analysis of the classification function of rural agro-pastoralists*

Classification in dynamic cloud has resulted in three types of breeders depending on the structure of households in terms of family labor and animal resources (cattle, sheep, goats, donkeys, and poultry). Table 3 presents the results of the final cluster centers following the method of classification of dynamic cloud and the results of the statistical test of significance of each parameter (variables) included in the classification.

First-class producers have the resources above mentioned below the sample average with the exception of household size and number of asin and poultry within the confidence interval (at the 95 % probability) of the average of the sample. This class includes 89 households, or 82.41% of the sample. A second class, whose average resourcing is slightly above the confidence interval of the sample mean, it has 18 households, or 16.67%. The third class includes a household whose average resource endowment is largely above the confidence interval of the sample mean. Given the non-random sampling technique, the last two classes were merged. This approach was preferred to eliminate the case of the third class, in order to maintain the current size of the sample. The result of the analysis is made on the basis of two types (resource classes) agro-pastoralists identified by structural variables such as household size, the relative size of cattle herds, sheep, goats, asin and poultry.

**Analysis of the discrimination function of rural agro-pastoralists**

The estimate of the canonical discriminative function (Table 4) indicates a value of 1.43 Eigen with a canonical correlation of 77%. Wilks' lambda is estimated at 0.41 associated with a chi-square of 90.58 (df = 6). The estimated canonical function discriminates highly significantly (P = 0.00) producers based on resources, livestock and family labor.

The correlation between each variable and the discriminant function indicates that goats contribute significantly to discrimination, with a value of 0.92. They are followed by sheep (0,64). The number of cattle, household size, the number of donkeys and poultry are relatively weakly correlated with the estimated function. Thus, the marginal contribution of each variable is given by the value of the coefficient. With the exception of donkeys, all variables have the expected sign. In other words, the increase in the number of sheep, goats, of family labor and poultry, increases the probability that the household belong to the class of rich agro pastoralists. In contrast, a high number of donkeys increases the probability of producer belonging to the class of poor. Indeed, the character trait of donkeys put them in the situation of being owned for the needs of traction, rather than the reproductive breeding.

**Analysis of livestock activities operated by the two types of agro-pastoralists**

*The structures of farms*

The analysis of the herd structure of both types of agro-pastoralists have similar characteristics. Thus, in terms of cattle, breeding (female cattle over three years) represent 44% and 34% of the livestock in poor and rich households respectively. Breeding males represent 9% of the cattle in poor households and 6% in average.

The structure includes 48% of sheep breeding females and 11% of breeding males in poor households against 41% and 3% of the livestock in the rich. Finally, the goat population is structured with 47% and 6% of reproductive breeding among the poor against 42% and 4% respectively for the rich. But generally, the process of accumulation of ruminants does not differ in the level of resources. Whatever the level of resources, producers keep more than female reproductive breeds than males reproductive breed. Although it is not possible at this stage to estimate the sex ratio of cattle, these results fairly high ratio of female / male reproductive.

When it comes to ruminants species, poor households have an average of about 10 sheep, seven goats and seven cattle. Different estimated coefficients of variation give 78% for sheep, goats for 111% and 132% for cattle. Although belonging to the same class level of resources, the distribution of ruminant livestock differs depending on the species. Sheep are less unequally distributed than goats and cattle. Similarly, wealthy households have an average of 41 sheep, 38 goats and 24 cows. The coefficients of variation of the possession of ruminant livestock in wealthy households are 84%, 53% and 114% respectively for sheep, goats and cattle. In the class of high level of resources, the distribution of ruminants is less unequal for the three species.

**Digital productivity compared livestock**

Numerical productivity is an indicator of the evolution of ruminant livestock in the households surveyed. Productivity gives an indication of the growth of ruminant livestock. Table 6 shows that the livestock of poor households is numerically more productive than their richer counterparts, with the exception of cows. In addition, goats are relatively more productive than sheep and cattle in poor households. In contrast with the rich, cows have a higher productivity than small ruminants in terms of numerical productivity.

Net productivity is an indicator that takes into consideration not only births, but deducted neonatal mortality. This is an adjustment of the gross productivity, which measures the level of actual livestock productivity. The result of the net productivity in rich households shows goats and sheep have hardly produced a female lamb. In general, the net productivity of ruminant livestock is better in poor households than in rich.

**Estimation of the reproductive parameters of livestock**

Estimation of some reproductive parameters in agro-pastoralists provides important information for improving animal production. Table 7 summarizes the main parameters that influence the numerical productivity of livestock. The results show no significant difference between the two classes of level of resources in comparison to the reproductive parameters considered. The age of the first calving of cows is estimated at 47 months and 48 months respectively in the class of poor farmers and the rich. The calving intervals are approximately 21 months and 20 months for cattle belonging respectively to the rich and poor. In contrast, the weaning age is relatively lower among the poor (12 months) than the rich (15 months). The life span of a cow is higher among the rich (141 months) than the poor (136 months). The cows are kept in lactation less time in the class of poor households (6 months) than among the rich (12 months). Whilst, they are kept longer in the herd of poor households than in rich. Consequently, a cow belonging to the class of poor produces on average 9 cows before being released from the herd, against 8 for the rich.

The same trends are noted in ruminants with a few exceptions. For the sheep, the first birth interval and lactation length does not vary between the two types of agro-pastoralists. Consequently, the total number of calving during the life of an animal in the herd did not differ between the types of producers. There is a slight difference between the two types in relation to the age at first calving and that of weaning. However, the life span of sheep differs significantly between the two classes of resource: rich sheep having a longer career (62 months) than those of the poor (41 months). Similarly, the rich keep their sheep in the herd longer than the poor. Goats have the same results. The only difference from the sheep is that goats are relatively early in calving (age at first calving), produce longer (DC) and are kept a little longer in the herd (DVT). Consequently, the number of babies throughout the lifespan is higher in goats (about 10 heads) than sheep (8 heads).

**Exploitation of livestock for meat**

The analysis of the operation of livestock for meat by agro-pastoralists (Table 8) indicates various facts according to the situation of the species and the type of operation. Three types of operations were considered: commercial (buy and sell), domestic consumption and social exploitation (received or given without monetary exchange). The results indicate that the ruminants are being a larger commercial operation in absolute value than other forms of exploitation. Regardless of the level of resources, all surveyed households are net sellers, except for goats where poor households are net-buyers. For cattle, the commercial exploitation rate is estimated at 6% and 8% respectively of livestock among poor and rich households. For the sheep, the poor exploited 6% of their livestock against 13% for the rich. Finally, the poor were net-buyers with a reenactment of 5% of their livestock, while the rich have been net sellers, with an operating rate of 10%.

When it comes to auto consumption of meat, the results indicate generally that cattle are rarely affected by this type of operation (0.3% among the poor and 0% for the rich). Sheep are also really concerned (6% and 2% respectively for the poor and the rich. Finally, goats are the species most used in consumption (11% of the poor and 6% for the rich. Regardless of species considered, the poor have higher operating rates for home consumption. Finally, social exploitation of livestock shows that poor households received more gift than the rich. Such donations represent 9% of cattle among the poor and 2% for the rich. For Goats, the poor received 0.3% of their livestock as a gift, while the rich have received 0.7%. No information on donations was reported for sheep. This does not necessarily mean that the social role of sheep is zero compared to other species.

**Exploitation of livestock for milk**

The use of livestock for milk concerns two species of ruminants (cattle and goats). Some cases of exploitation of camels for milk have been reported. The decision to use the milk is significantly related to the type of resources. On a global basis, 51% of households surveyed said they used the milk. The analysis based on the level of resources shows that 84% of wealthy households exploit milk against 43% among the poor (Table 9).

The use of bovine milk is the most prevalent in the households surveyed (61% of households surveyed). It is independent of the level of resources available to the household. In fact, it concerns 66% of the poor and 52% rich. The second frequently exploited species for milk are goats. Sheep milk is used in 25% of poor households and 45% of the rich. Finally, 3% of wealthy households exploit milk.

An important fact to note is that whatever the season of the year, the less resourced households market a relatively larger share of their milk production than the rich. For example, just near the end of winter (post-harvest and cold dry season), the quantity marketed often reaches 50% of the production.

The analysis of the evolution of the price of milk shows an opposite trend compared to the production. For example, the price of cow's milk during the rainy season is estimated at 181 FCFA / liter and increased steadily until hot dry season (Table 10). Rising prices of milk cattle between the rainy season and the hot dry season reached 34%. The price of goat milk is estimated to average 189 FCFA / liter and only increase post-harvest season of 9%. In contrast, during the dry season, these prices fall by about 8%.

It is important to note that goat milk sells relatively more expensive than that of cows in certain seasons. The price differential is estimated at 8 FCFA / liter during the rainy season and 16 FCFA / liter post-harvest season for the goat milk. However, in the cold and hot dry seasons, cow milk is sold more than goat milk. During these seasons, the price differential was assessed at 44 FCFA / liter cold dry season and 67 FCFA / liter.

Paralleling the seasonal pattern of production, it appears that the increase in milk prices for the two species considered (cattle and goat) is less than proportional to the decrease in production. Indeed, between the rainy season and the decline in production reaches between 70% and 85% dry season, while the price increases between 9% and 34%. This means that the variation in milk prices is not only influenced by the availability of dairy products [1]**.**

**Husbandry practices**

*Analysis of Animal Health conduct*

Animal health behavior is a very important component of the technical performance of farms in rural areas. Although the study is not able to collect investment data concerning this component, the analysis of the use of veterinary treatments is used to assess the behavior of agro-pastoralists in relation to animal health. Thus, it should be noted that among the three ruminant species, cattle health receives attention more frequently than sheep and goats. The decision to treat or not is closely related to the resources available to the household. The chi-square test of Pearson indicates a significant difference in the implementation of health modes conducted by level of resource (at 1% for cattle, the threshold of 5% for sheep and goats). Indeed, the proportion of households who say they have not treated their animals is decreasing for cattle (0% to about 30% rich and the poor), sheep (32% rich and 35% among the poor) to goats (36% rich and 72% poor).

When an agro-pastoralist decides to treat his animals he has three choices: (1) use of chemotherapy only, (2) use of traditional therapy only and (3) a combination of both. The results indicate that the preference of farmers is oriented toward chemotherapy whatever the species and the level of resources. The use of traditional therapy is rare and only affected 1% of poor households who have applied it to sheep. However, there are cases of combination of chemotherapy and traditional therapy. In terms of cattle, 5% and 11% respectively rich and poor households have been using the combination of these two modes of veterinary treatment. For sheep, 2% poor and 11% rich have used this combination. Finally for goats, using a combination of treatment methods concerned 1% of poor households and 11% rich.

**Table 1: Ethnicity, education et community life of the sample**

| Variables | Frequencies (%) | Variables | Frequencies (%) |
|---|---|---|---|
| **(i) Ethnic groups** | | **(iii) Level of schooling** | |
| ❖ Fulanis | 25 (23.1) | ❖ illiteracy | 44 (40.7) |
| ❖ Fulcé | 70 (64.8) | ❖ Elementary school | 25 (23.1) |
| ❖ Rimaïbé | 1 (0.9) | ❖ Secondary school | 38 (35.2) |
| ❖ Mossi | 4 (3.7) | ❖ Arab | 1 (0.9) |
| ❖ Bellah | 7 (6.5) | **(iv) literates** | 18 (16.7) |
| ❖ Others | 1 (0.9) | **(v) Member of community organizations** | 88 (81.5) |
| **(ii) High of the sample** | 108 (100) | | |

The figures in parentheses indicate the percentage of corresponding frequencies of the sample.

**Table 2: Representativity of the types of animals shelters (% des ménages)**

| Shelter/especies | Cattle | Sheep | Goat | Poultry | Donkey |
|---|---|---|---|---|---|
| Animal parc | 42.6 | 55.6 | 48.2 | - | 6.5 |
| Shades | 16.7 | 11.1 | 11.1 | 5.6 | 13 |
| Posts | 1.9 | 6.5 | 6.5 | - | 14.8 |
| Open air | 7.4 | 3.7 | 2.8 | - | 0.9 |
| Roofed animal parc | 9.3 | 11.1 | 6.5 | - | 0.9 |
| Huts | - | - | - | 22.2 | 1.9 |

*Notes: The figures do not total to 100% because the producers do not have all the species*

**Table 3: Final classification center**

| **Variables** | **Classes of producers** | | | Sample (N=108) | **Test ANOVA** | |
|---|---|---|---|---|---|---|
| | Poor class (nb=89) | Rich class (nr=18) | Very rich class (ntr=1) | | **F** | **Probability** |
| Size of household | 10.82 | 15.11 | 29.00 | 11.70 | 9.09 | 0.00 |
| Cattle | 7.01 | 18.50 | 130.00 | 10.06 | 89.23 | 0.00 |
| Goats | 9.66 | 34.78 | 160.00 | 15.24 | 133.57 | 0.00 |
| Sheeps | 6.85 | 36.89 | 60.00 | 12.35 | 69.06 | 0.00 |
| Donkeys | 0.70 | 1.22 | 7.00 | 0.84 | 30.95 | 0.00 |
| Poultry | 13.52 | 26.17 | 0.00 | 15.50 | 4.39 | 0.02 |

Fischer test (F) is solely used for a description because the classes have been chosen to maximize the differences between the cases within different classes. For that the noticed probability has not been corrected and consequently cannot be interpreted.

**Table 4: Coefficients of the canonic function of discrimination and intra-type correlation**

| **Variables** | **Coefficients[a]** | **Correlation[b]** |
|---|---|---|
| Goats (number of animals) | 0.767 | 0.923 |
| Sheeps (number of animals) | 0.261 | 0.639 |
| Cattle (number of animals) | 0.163 | 0.391 |
| Household (persons) | 0.122 | 0.278 |
| Donkeys (number of animal) | -0.064 | 0.271 |
| Poultry (number of animals) | 0.219 | 0.205 |
| Summary of the discriminative function | | |
| Eigen value | % of the variant | Canonic correlation |
| 1.430 | 100 | 0.767 |
| Lambda of Wilks | khi two (ddl) | Probability |
| 0.411 | 90.579 | 0.00 |

[a]*The standardized coefficient of the canonic discriminative function*
[b] *intra type correlation between the discriminative variables and the standardized discriminative function*

**Table 5: Average structure of the ruminant herds by category of agro-pastoralist**

| **Structure** | **Cattle** | | **Sheep** | | **Goats** | |
|---|---|---|---|---|---|---|
| **Sex-age** | **Poor** | **Rich** | **Poor** | **Rich** | **Poor** | **Rich** |
| M 0-1 yr | 0.60 (1.07) | 1.32 (1.16) | 1.22 (1.41) | 4.37 (3.17) | 0.81 (1.05) | 5.26 (4.68) |
| M 1-4 yrs | 1.08 (1.35) | 2.11 (1.79) | 0.94 (1.23) | 1.47 (2.04) | 0.63 (0.99) | 1.68 (2.40) |
| M 4-6 yrs | 0.60 (0.94) | 1.11 (1.45) | 0.95 (1.37) | 0.89 (1.24) | 0.31 (0.75) | 1.21 (1.32) |
| M + 6 yrs | 0.02 (0.15) | 0.32 (1.00) | 0.11 (0.41) | 0.32 (1.16) | 0.1 (0.38) | 0.26 (0.56) |
| F 0-1 yr | 0.69 (1.09) | 1.47 (1.39) | 1.27 (1.49) | 5.47 (6.17) | 1.13 (1.45) | 6.32 (5.51) |
| F 1-4 yrs | 0.81 (1.81) | 2.89 (2.66) | 0.57 (1.14) | 1.47 (1.95) | 0.57 (1.21) | 3.26 (4.71) |
| F 4-6 yrs | 1.09 (2.26) | 3.11 (4.12) | 1.14 (1.61) | 4.53 (5.17) | 1.13 (2.24) | 5.84 (7.60) |
| F + 6 yrs | 2.03 (3.88) | 5.16 (5.04) | 3.34 (3.25) | 12.21 (13.55) | 2.13 (2.75) | 10.32 (8.52) |
| Herd | 7.06 (9.34) | 24.37 (27.77) | 9.70 (7.53) | 41.37 (34.91) | 6.89 (7.67) | 38.11 (20.26) |

*M= male; F = female. Standard changes are between parentheses*

**Table 6: Productivity of the ruminant herd by level of ressources (number/female)**

| | Gross productivity | | Net productivity (mortality néo-natal) | |
|---|---|---|---|---|
| Species | Poor | Rich | Poor | Rich |
| Cattle | 0.80 (0.95) | 0.89 (1.07) | 0.73 (0.97) | 0.81 (1.04) |
| Sheep | 0.99 (1.90) | 0.53 (0.45) | 0.91 (1.90) | 0.46 (0.41) |
| Goats | 1.44 (1.26) | 0.55 (0.46) | 1.35 (1.19) | 0.49 (0.46) |

*Standard deviations are within parentheses.*

**Table 7: Some reproduction parameters of ruminants (in number of months except otherwise indicated)**

| Species | Cattle | | Sheep | | Goats | |
|---|---|---|---|---|---|---|
| Parameters | Poor | Rich | Poor | Rich | Poor | Rich |
| AgPMB | 46.56 (8.64) | 47.64 (8.28) | 19.00 (7.32) | 16.32 (6.39) | 13.68 (4.42) | 14.47 (5.46) |
| IMB | 20.96 (5.13) | 20.16 (6.33) | 11.47 (3.04) | 11.00 (3.45) | 10.97 (2.72) | 10.52 (3.03) |
| AgS | 12.43 (4.44) | 14.68 (5.88) | 7.81 (3.35) | 6.44 (2.28) | 5.62 (2.11) | 6.06 (1.98) |
| DC | 135.84 (35.04) | 141.36 (3.39) | 40.78 (44.19) | 61.79 (45.41) | 42.68 (44.56) | 65.78 (45.27) |
| DL | 6.48 (4.64) | 11.67 (6.03) | 4.81 (2.19) | 5.35 (1.34) | 3.86 (1.36) | 5.27 (1.41) |
| DVT | 215.28 (36.12) | 211.28 (38.16) | 49.29 (52.01) | 90.47 (77.20) | 51.31 (54.57) | 92.12 (78.98) |
| NPC (number of animals) | 9.26 (2.78) | 8.16 (3.53) | 8.07 (2.13) | 8.42 (2.85) | 10.96 (3.25) | 10.21 (4.69) |

*Notes: AgPMB = Age at first birthing; IMB = Interval between births; AgS = Age at weaning; DC = Lifespan corresponding to its reproductive period; DL = Duration of milking period; DVT = Length of life in the herd corresponding to the time spent by the animal in the herd; NPC = Number of small products by career. Standard deviation in parentheses.*

**Tableau 8: Usage ratio of on feet ruminant herd (% of the herd)**

| **Species** | **Trade** | | **Meat consumption** | | **Social** | |
|---|---|---|---|---|---|---|
| | **Poor** | **Rich** | **Poor** | **Rich** | **Poor** | **Rich** |
| **Cattle** | -5.88 (24.09) | -7.69 (69) | -0.32 (2.52) | -0.00 (0.00) | 9.37 (25.71) | 1.75 (5.94) |
| **Goats** | -6.23 (73.35) | -12.76 (18.20) | -5.68 (6.92) | -2.26 (2.61) | | |
| **Sheep** | 4.84 (40.43) | -10.02 (14.05) | -10.88 (24.79) | -5.52 (4.93) | 0.31 (2.50) | 0.66 (2.86) |

*The symbols – or + refer respectively to an out or in numbers of animals for the household.*

**Table 9: Milk usage frequencies and treated species (% of households)**

| | Poor | Rich | Total |
|---|---|---|---|
| Milk exploitation | | | |
| Yes | 38 (43.18) | 16 (84.21) | 54 (50.47) |
| No | 50 (65.90) | 3 (15.79) | 53 (49.53) |
| Treated species | | | |
| Cattle | 35 (66.04) | 15 (51.72) | 50 (60.98) |
| Sheep | 18 (25.35) | 13 (44.83) | 31 (37.80) |
| Camels | 0 | 1 (3.45) | 1 (1.22) |

**Table 10: Seasonal variations of the price of milk among milk producerst (F CFA/liter)**

| | Rainy season | Post harvest | Cold-dry season | Hot dry season |
|---|---|---|---|---|
| Cow milk | 181.25 (35.76) | 190.63 (50.43 | 218.75 (35.94) | 242.31 (89.20) |
| Sheep milk | 189.29 (31.81) | 206.25 (31.46) | 175.00 | 175.00 |

*Standard deviations are within parentheses*

**Table 11: Percentage of households according to the criteria of selection of reproductive species of ruminant livestock (% of households)**

| **Criteria** | **Cattle** | | **Goats** | | **Sheep** | |
|---|---|---|---|---|---|---|
| | **Poor** | **Rich** | **Poor** | **Rich** | **Poor** | **Rich** |
| **Breed** | 4.55 (2.27) | 26.32 (15.79) | 1.14 | 10.53 | 0 (1.14) | 10.53 |
| **Robe** | 2.27 | 10.53 | 4.55 (2.27) | 26.32 (10.53) | 2.27 (2.27) | 10.53 (10.53) |
| **High** | 4.55 | 0 | 2.27 | 15.79 (5.25) | 2.27 (1.14) | 10.53 (5.26) |
| **Shape** | 0 | 15.79 | 0 (1.14) | 10.53 | 0 | 10.53 |

*The values in parentheses are the percentage of households who practice the selection of females on the basis of the criteria considered*

**Table 12: Frequency of the need of improved technology for animal production**

| Technological categories | Class of the level of resources | | Total sample |
|---|---|---|---|
| | Poor | Rich | |
| Genetic improvement | 1 (1.14) | 1 (5.26) | 2 (1.87) |
| Food rationing | 35 (39.77) | 11 (57.89) | 46 (42.99) |
| Animal health | 43 (48.86) | 10 (52.63) | 53 (49.53) |
| Fodder seed | 1 (1.14) | 0 (0.00) | 1 (0.93) |
| Fattening technics | 16 (18.18) | 0 (0.00) | 16 (14.95) |
| Feeding technique | 15 (17.05) | 3 (15.79) | 18 (16.82) |
| Others (training, loans, pastoral hydrology) | 24 (27.27) | 5 (26.32) | 29 (27.10) |

*Bracketed percentages were calculated on the basis of elementary technology choice. The sum of frequencies is not equal to the size of the resource classes due to the possibility for producers to operate several technological choices*

## Analysis of patterns of food behavior

Food pipe for livestock remains also an essential component of the productivity of livestock in rural areas. In order to assess the practices of feed, food resources provided by the breeders to their animals were divided into four groups: sub-agro-industrial (SPAI), agricultural by-product (ABP), the natural forage and minerals (salt).

Shepherding is a established practice in rural farms, it is important to analyze the practical implementation by agro-pastoralists to improve livestock productivity strategies. Given the seasonal variability of natural pasture, it is expected that farmers' complementary strategies are dependent on the time of year.

The results show that during the rainy season, food supplementation (maximum 2%) is rarely a strategy implemented by the agro-pastoralists. Very few poor households have offered sub-agro-industrial or natural feed in addition to their animals. However, during the rainy season, the cattle feeding strategies are based on mineral intake. Whatever the level of resources, producers have implemented strategies of mineral supplements that affect all species and categories in each species.

Cows (male and female) are frequently supplemented. Approximately 56% of poor households and 89% of rich households practice mineral supplementation to male cows. The supplementation of minerals to female cows accounts for 51% and 89% respectively in the poor and rich households. Whereas, young cows receiving mineral supplement reaches 47% in poor households and 84% in rich. For sheep, the allocation of mineral supplement for all categories (young, male and female) is almost equal to the level of poor households frequencies. The rich pay more attention to youth and males (74% of cases) and to relatively few females (68%). Finally, for goats mineral supplementation during the rainy season is between homogeneous categories of goats (young, male, female). However, rich households contribute more frequently (79% of cases) a mineral supplementation goats than poor households (between 35% and 39% of cases).

The analysis of the allocation of food supplement during the hot dry season presents results that contrast with the strategies used by producers in the rainy season. At this time of the year characterized by a scarcity of natural pastures, all kinds of food resources are collected and distributed to animals by the two classes of resources level (poor and rich).

Thus, the distribution of agro-industrial by-products (SPAI) to ruminants is practiced both by the poor than the rich. A constant rate in the distribution of SPAI is that the proportion of producers who implement this complementation strategy seems to follow a decreasing gradient of female ruminants, youth through males. For example, in poor households, female cows receive SPAI in 45% of cases, males in 39% of cases and 24% of youth. In the class of wealthy households, female cows are supplemented in 79% of cases in males and 63% of young people in 42% of cases. The same gradients frequency of allocation of SPAI are noted in sheep (except males and females in the class of poor households), and goats.

Agricultural by-products (ABP) are also subject to collection and distribution to ruminants in the two classes of households. The gradient of frequency allocation SPA is similar to that of SPAI in the class of wealthy households. Females are more frequently supplemented with the SPA that males and young people, whatever the species. In the class of poor households, the allocation of SPA different categories seem influenced by the species. For cows, females and males receive equal attention largest (42% of cases) that young people (22% of cases). For sheep, males are more frequently served (51% of cases) in PPS than females (47%) and youth (36%). In contrast to goats, more producers pay attention to females (15% of cases), followed by males (13% of cases) and finally to young people (9%).

The allocation of natural fodder for livestock is much more heterogeneous than the SPAI and SPA face. The allocation frequency of natural fodder to cows in poor households is as follows: 39% of cases distributed to males, 34% females and 18% for young cows. Sheep benefit from the distribution of natural fodder in 47% of cases for males, 38% females and 31% for young people. Finally, the female goats more frequently given (11% of cases) of natural fodder than males (10%) and young goats (8%).

By implementing a comprehensive dietary supplement during the hot dry season, the producers make a forced reallocation of resources. One visible consequence of this strategy is a lower allocation of mineral supplement compared with values obtained during the rainy season frequencies. Thus, the level of male cattle, 35% of the poor (against 56% in the rainy season) and 42% rich (against 89% in the rainy season) provide mineral supplement. It is the same for other cows considered (young females). Mineral supplement to sheep is also affected. For example, 33% of the poor (against 41% in the rainy season) and 32% rich (against 74% in the rainy season) practiced a mineral supplement during the dry season. Finally, mineral supplement to goats has not escaped the impact of the re-allocation of resources. Approximately 10% of the poor (against 36% in the rainy season) and 26% high (against 78.95 in the rainy season) distributed minerals for male goats in the dry season.

**Analysis of management modes of reproduction**

The control of reproduction is made through the selection of parents, but it does not occur consistently for all producers. Indeed, only 21% of poor households and 53% rich perform this practice. Castration is a management method of reproduction. It is practiced in 10% of cases in the class of poor households and 21% for the rich.

Several other criteria can be used in the selection of parents. These criteria apply to both males and females. Table 11 summarizes some of the criteria used by producers in the selection process of breeding (matrices) for ruminant livestock.

**Analysis of potential technical innovations**

The analysis of the potential for technological innovations among agro-pastoralists is crucial to the success of the actions of livestock development. It allows to identify the potential demand for improved systems of agro-pastoral production.

*Technical innovations in livestock*

Technical innovations requested by producers in livestock have been grouped into areas: (1) Breeding (2) Improvement of cattle feed, (3) animal health, (4) technical fattening (5) Technical feeding (hay and fodder conservation), (6) fodder seeds). Table 12 presents the technological choices made by the producers.

In general, animal health is a major constraint to livestock production in which many producers (about 50% of households surveyed) would like to invest. The potential demand for animal health is more pronounced in rich households (53% of cases) than the poor (49%). The second technological area of interest is food rationing livestock. Interested in this field are about 43% of households with 58% rich and 40% poor. The third concern of breeders rather involves other types of interventions other than technology. These are training (technical and livestock farm management), pastoral water and access that credit. Approximately 27% of producers (including 26% rich and 27% poor) would like these areas are also taken into account.

The feeding techniques also have potential for adoption by the households surveyed. Potential demand in terms of proportion of households' applicants is estimated at about 17% of the total sample, 16% rich and 17% poor. Finally, two technology areas seem to an interest of only poor households. These are fattening techniques (18% poor) and fodder seeds (1%). However this should not be interpreted as if the rich do not practice fattening, but rather by the fact that they already master this technology. As a result their needs might be oriented toward access to credit to improve their fattening business. However, the poor may have been excluded in the process of diffusion of this technology because of the cost of implementation will work (have animals, equipment purchases, have food and veterinary products, etc.).

It should be noted that in general the producers combine several technological areas in their choice. Thus, the association rationing food and animal health is the first and most common option (27% of the sample, 26% and 32% of poor-rich) with other types of interventions such as training, access credit and pastoral water (27% of the sample with 27% poor and 26% rich).

Finally, the chi-square test of independence between Pearson needs of technological innovation and the level of resources available to households showed no significant [3].

Influence that its needs improved animal production technologies. In other words, whether the producer is rich or not in animal reproduction resources, it does not affect his or her need of improved production technologies.

## CONCLUSION

The results of this study allow us to draw two important conclusions on which depends the improvement of the living conditions of rural households in the Sahelian zone. First, the typology of agro-pastoralists revealed that producers are heterogeneous in terms of staffing productive resources. Two classes of producers have been identified and classified according to the level of available resources. The main resources used in discrimination are: family labor, and (sheep and goat bovine, asin, poultry) animal resources. Compared to the average of the sample averages of resources available to the two classes are statistically and significantly different. An agro-pastoralist class has resources below the confidence interval of the sample mean. That class has been described as poor and represents 82% of the sample. The second class has resources beyond the confidence interval of the mean of the sample (18% of the sample), and is described as rich. The sample was therefore unable to include the class average resources. However, having studied the two extreme classes helps us deduct indicators for monitoring and evaluation that will consider the middle class.

The second conclusion which draws up from the first is that the strategies and husbandry practices and associated performance are strongly related to the level of resources. Indeed, the decision to adopt a technology depends not only on the needs and the desire for change of producers, but also its ability to support change given the resources they have to generate the funds needed for investment in new production techniques.

The ultimate goal of this study was to contribute to a better clarification for decision taking in the field of the fight against poverty in Burkina Faso, and its Sahelian region in particular. Poverty is a complex phenomenon that can only be understood in relation to several dimensions: physical, social and cultural. Indeed, understanding of the principles of scarcity, economic capacity and social welfare.

This article uses the concept of relative poverty. It is not based on the expenditure as is generally the case with previous micro or macro-economic studies. It is based on the distribution of productive resources that generate income spent by households. Therefore the concept of poverty requires the delimitation of the specific content of proposed indicators related to (1) income improvement and (2) improvement of productive resources.

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