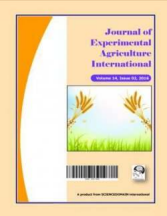

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Analysis and Diagnosis of the Diversity of Forage Resources in the Semi-arid Region of Setif

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

The issue of sustainable development of livestock systems in Algeria, is in the mode of resolution of the issue of the growing gap between supply of forage and needs of a growing pet population.
In this context, this study aims to analyze the current situation of forage resources in the semi-arid region of Setif which is, by its central position a crossroads between East and West, North and South of Algeria. The study was carried out over two consecutive seasons (2009/2010 and 2010/2011) and at different sites (North, South and Center) through two lots of farms. The methodological approach adopted consists in a series of investigations of a large number of farms (58 for 2009/2010 season and 61 for 2010/2011 season) which are mainly based on a survey to a broad way for gathering maximum information including forage resources in the study area. The questionnaire consists of three components: The social side, the technical side and the economic one; also making a socio-geographical characterization of vetch in the same region. The results of these investigations revealed that this region is characterized by the combination of cereals (especially durum wheat) to breeding which the power supply suffers from a large deficit and which relying heavily on very modest production of natural forage resources as the share of fodder crops remains negligible in front rate of needs of animals which are growing increasingly leaving the sector always dependent upon the foreign. This situation prevailed for many years.

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The results of the typological approach as statistical treatment of the data collected (multiple components analysis "ACM" and Ascending Hierarchical classification "CAH"), helped first to make a brief characterization of the illustrative variables, then identify by the active variables, six classes throughout the first sample (2009/2010) and three or four classes in the second sample (2010/2011); these classes differ from each other mainly in terms of areas: the third class for each seasons, being the largest with 919.14 ha on average. Developing a typology of farms in the study area, has helped to identify an elite among the samples constituted of the classes nº. 3,2 and 1, however a very important point emerges from this study concerning all the farms which is deficiency of feed resources including cultivated forages such as alfalfa, sorghum, etc ... accusing a deficit of 84.48% and more particularly of the kind Vicia that is almost absent, registring a low presence of 7% compared to the samples.

Keywords: Diagnosis; forage situation; investigation; survey; semi-arid region of Setif.

1. INTRODUCTION

For millennia, animal production has been associated with all agricultural practices [1]. Indeed, food is undoubtedly one of the major constraints to livestock in Algeria. A review of the feed balance has identified a low rate of coverage of livestock needs, which results in a negative impact on animal productivity. Compared with the area reserved for all herbaceous crops (cereals, vegetable crops ....), cultivated forages cover less than 10% of the UAA (Useful agricultural area), while natural forage cover a larger area, between 80 and 85% [2].

According [3], the land used for forage production covers 33 million hectares distributed among the native grasslands (0.1%), fodder crops (1.6%), fallow (10.6%) and pastures and rangelands (87.7%).

These livestock feed sources remain largely subject to weather conditions and production is highly dependent and most often very little controlled. Spontaneous species of pastoral and / or forage interest, play an extremely important role. However, Abdelguerfi has not stopped denouncing the national chronic deficit in animal products since 1989; which deficit increases under runaway population pressure and changing eating habits. According to him, the two products (milk and meat), are just as cereals, a significant burden for the country and a heavy dependence on foreign and attempts to increase the number of livestock and imports of high genetic potential animals, have not improved the situation; This is mainly due to the lack of quantity but also in quality fodder; this failure added to its insecurity, are the cause of the livestock situation and its periodic decimation. [4] estimated the deficit at 3-3.5 billion UF and 224 million kilograms of MAD (Digestible nitrogenous matter).

In the area known potential for milk production, agricultural surfaces are cereal dominance. Stubble, straw and fallows occupy over 50% of the forage area while cultivated fodder occupy only 10% of these surfaces [3].

At the end of the first decade of the new millennium [5] report that in the semi-arid region of Setif, breeding is an integral part of production systems; however, the available food resources fail to satisfy the growing needs of livestock and severe degradation of grazed lands has engendered a food deficit, especially in late summer and early winter. Forage production is just as cereals for human consumption, a burden on the country and a strong dependence from abroad; the satisfaction of livestock needs comes essentially from pastures and rangelands and derived from cereals (86%), fodder crops are involved in 13% of the national herd rationing and natural grasslands provide only 1%.

The valuation of plant genetic resources and knowledge of forage and pastoral interest species, represents an essential concern, hence the choice of our study. We can also justify our choice by the following:

- The Place occupied by fodder in animal feed and in the production of milk and meat, ... [6] (Hamadache 2001) which justly is to short of needs of the population.
- The Ability to identify problems that hinder the development of fodder crops and technical improvements.
- The Feed industry is currently considered a suitable field in terms of research and

scientific work in the world. But this is not yet fully fructifying in Algeria, notably in Setif.

2. MATERIALS AND METHODS

2.1 Methodological Approach

The methodology consists of a series of investigations of a large number of holdings in two successive seasons (2009/2010 and 2010/2011 with respectively 58 and 61 farms).

The farms surveyed were selected randomly, Designated from the management of agricultural services (DSA) of the wilaya of Setif.

These surveys are mainly based on a questionnaire to a broad way for gathering maximum information including forage resources in the study area. The questionnaire consists of three components:

The social, the technical and the economic side.

2.2 Sampling

The surveyed farms are divided into three sub-areas with different agro-ecological characteristics (soil type, vegetation, altitudinal gradient, rainfall etc ...). Among all the towns of the province visited, seventeen (17) in 2009/2010 and eighteen (18) in 2010/2011, were selected for the realization of the survey; Table 1 gives the distribution of surveyed farms by municipality where about 28% of the farms (both seasons) are located in the South region (lower semi-arid), 41% (2009/2010) and 32.79% (2010/2011) in the central region and 31% in 2009/2010 and 39.34% for 2010/2011 in the Northern Setif Province (upper semi-arid).

The surveys were conducted in the field with farmers during the period from March to June for 2009/2010 and March to May for 2010/2011.

2.3 Statistical Analysis Methods and Tools

All information gathered during the investigation, have been converted into digital data and organized database of Microsoft Excel version 2007. Using PivotTables in Excel 2007, we were able to calculate averages, standard deviations and the percentages for a brief characterization of a hand; on the other hand, the logiciel [7] was used for the realization of a farm typology by the statistical treatment of data that represent the variables (qualitative and quantitative). Typology is a method of comparison, in the sense that

Table 1. Distribution of farms surveyed by municipality (2009 / 2010 - 2010 / 2011)

Zone	2009/2010		2010/2011	
	Commune	**Number of farms**	**Commune**	**Number of farms**
North	-Ain Kabira	1	-Ain Kabira	2
	-Ouled Adouane	1	-Ouled Adouane	2
	-Ain Abassa	5	-Ain Abassa	6
	-Amoucha	3	-Amoucha	3
	-Ain roua	3	-Ain roua	3
	-Ouricia	2	-Bougaà	3
	-Beni fouda	4	-Ouricia	2
			-Beni fouda	5
Center	-Ain Arnet	6	-Ain Arnet	4
	-Sétif	6	-Sétif	6
	-El-Eulma	5	-El-Eulma	4
	-Guelta Zerga	2	-Guelta Zerga	3
	-Ouled Saber	5	-Ouled Saber	3
South	-Guellel	4	-Guellel	4
	-Guedjel	6	-Guedjel	2
	-Bazar Sakhra	3	-Bazar Sakhra	2
	-Ain lahdjer	2	-Ain lahdjer	2
	-Eloueldja	1	-Mazloug	5
Total	17	58	18	61

individuals of the same type (group or class) are very homogeneous and heterogeneous them with individuals of other types [8], the typology is based on two approaches:

- An Analysis of multiple components (ACM).
- An Ascending hierarchical classification (AHC).

This method of classification is done on the number of axes deemed interesting in the principal components analysis [9].

3. RESULTS AND DISCUSSION

3.1 Season 2009/2010

3.1.1 Study of the typology proper of surveyed farms

With two approaches (ACM and CAH), this typology has to distinguish three different partitions; the first with 4 classes, the second with 6 classes and the last with 9 classes, including all variables (active) and their modalities.

3.1.2 Choice of variables

Twenty two variables were selected for conducting the analysis of multiple components (ACM) to the typological classification of the studied farms. The choice fell on the variables that have a relationship with this theme and have a strong discriminatory power. They are called active in opposition with the rest of the treated variables that are denominated exemplary or illustrative variables. The variables involved in the analysis are the following:

The total agricultural area (SAT), the agricultural area (SAU), the useful dry agricultural area (SAUS), the irrigated agricultural area (SAUI), the surface of durum wheat (SBD), soft wheat area (SBT), the surface of the barley (SO), vetch area (SV), the surface of vetch-oats (SVA), the surface of the alfalfa (SL), the surface of the oat (SA), sorghum surface (SS), the surface of fallow (SCH), the pasture type (PT), the surface of gardening (SM), the surface of the prairie (SP), the tree area (SA) the conservation mode (TC), total forage area (SFT), the ratio of the total forage area / the agricultural area (SFT / SAU), the ratio of cultivated fodder area and agricultural area SFC / SAU), the ratio of natural forage area and the agricultural area (SFN / SAU)

The results of the ACM have identified several factors (axes) can explain the total variance between the 58 farms. We chose the most explanatory components of this variance; this is F1, which contributed with 17% and F2 with 8.96% which gives us a total contribution of 26.50% of the total variance.

3.1.3 Contribution of active variables in the formation of axes

According to Table 2, the variables SAT, SAU, SAUS, SAUI, SBD, SBT, SO, SVA, SL, SA, SM, SCH, SP, SAR, SFT / SAU, SFT, SFC / SAU and SFN / SAU and their modalities of which only the minimum and maximum are represented, contributing in the description of axis 1.

3.1.4 Correlation between variables

Analysis of correlation matrix of the variables in pairs revealed the existence of correlations between them identified as following:

- The Highly significant correlation between SFT and SCH (r = 0.995), which is why the fallow is the predominant forage source in the study area.
- The Correlation that ranges from highly to moderately significant between SFT and most of the variables: SAT (r=0.974) and SAU (r=0.890), which means that over these two surfaces are more large surface exploited for forage is important. However it is very weakly correlated negatively with SFC / SAU showing that cultivated fodder arouses little interest on the part of large-scale farms.
- By Moreover, it appears that the SAT is highly correlated with the SAU and SAUS (r = 0.948 and r = 0.944, respectively) and with the SAUI (r = 0.793) this suggests that the agricultural area of the sample is very important and is much more exploited than irrigated dry. We also note that the area devoted to tree crops is correlated with the market gardening (r = 0.770), indicating that these two types of crops are present at most of the farms at the same time and with surfaces almost equal.
- The correlation between SFC / SAU and SFT / SAU seems very low (r = 0.344), reflecting almost zero presence forage and if they exist, their surfaces are limited in the survey sample. By against SFT / SAU is highly correlated with SFN / SAU (r = 0.814) that means that natural forage (pastures r = 0.625 and fallow r = 0.610)) is

the main source of livestock feed in our area of study at the expense of cultivated forages (r = -0.231).

As regards the second axis (F2), the same variables (with their modalities) contribute by the following values (Table 3).

3.1.5 Study of the 6 classes partition

Fig. 1 summarizes the classes of this partition by specifying the modalities that best or most characterize them.

3.1.5.1 Class 1

This class includes nine farms (ie 15.51% of the total sample), all belonging to the type EAC. The total average agricultural area of 198.44 ha and the average agricultural area of 147.78 ha. The operating system dominant in this group is the practice of cereal crops including durum occupying an average area of 75.1 ha followed by forage over an area varying between 92.17 ha (including 62.16 ha and 9.77 ha of fallow to the meadow). This class is distinguished between illustrative variables, for milk production whose average is 324.44 liters.

3.1.5.2 Class 2

Six farms make up this class (10.54%) also belong to the type EAC. their agricultural area exceeds 330 ha on average, which operated in dry area is 291 ha, while the irrigated area cultivated is less than 40 ha. These farms are cereal vocation, mainly durum wheat with an average area of 159.83 ha then the barley cultivation with an area ranging from 10 to 50 ha, while for the total area of fodder, it does not exceed 115.83 ha in average with a maximum of 195 ha.

Livestock production that is important in the characterization of this class of farms, stands out for its production of eggs with eggs 67833.3 / day and a red meat production reaching 5793,330 kg / year.

3.1.5.3 Class 3

Most of the farms in this class are demonstration farms and 12% of the total (7 farms) and are characterized by SAU nearly 919 ha; their main orientation is represented by cereals durum wheat (257.28 ha), wheat (214.29 ha) and barley (71.14 ha), combined fodder production with SFT average 714.50ha (41.42 ha with oats, alfalfa with 0.57 ha, vetch oats with 2.14 ha, 0.14 ha with sorghum, natural meadows with 11.7 ha and 587.29 ha with fallow average) .the area cultivated in dry being of 787.50 ha and 38.14 ha of irrigated. Arboriculture is also present at this class with 12.58 ha in addition to vegetable crops (average 21.71ha); all reinforced by sheep farming with 460.28 average heads and a paltry cattle (mean = 42.71 units), plus thirty hives for beekeeping.

Table 2. Contribution of active variables and their modalities in the formation of axis 1

Variables	Contribution (%)	Contribution des Modalites (%)	
		Minimum	Maximum
SAT	2.98	Medium (0.22)	High (1.42)
SAU	10.05	Medium (0)	High (5.49)
SAUS	10.05	Medium (0)	High (0.07)
SAUI	5.59	Medium 0.07)	High (5.49)
SBD	9.26	Medium (0)	High (3.78)
SBT	4.56	Weak (0.04)	High (3.52)
SO	5.56	Moderatly Weak (0.02)	Medium (4.03)
SVA	2.62	Absent (0.21)	Present (3.01)
SL	1.61	Absent (0.21)	Present (2.26)
SA	3.69	None (0.08)	High (1.53)
SM	5.38	None (0.22)	High (3.16)
SCH	8.00	Weak (0.01)	High (2.68)
SP	4.50	Weak (0.01)	Medium (5.37)
SAR	3.86	Weak (0)	High (2.57)
SFT	2.41	Medium (1.47)	High (4.70)
SFT/SAU	10.50	Medium (0.42)	High (2.84)
SFC/SAU	1.16	Weak (0.12)	High (0.43)
SFN/SAU	6.04	Medium (0.01)	High (0.55)

Table 3. Contribution of active variables and their modalities in the formation of axis 2

Variables	Contribution (%)	Contribution of the Modalities (%)	
		Minimum	Maximum
SAT	6.41	Moderately weak (0.01)	High (3.97)
SAU	16.30	Moderately weak (0.06)	Medium (8.14)
SAUS	16.30	Moderately weak (0.12)	Medium (8.14)
SAUI	3.63	weak (0.02)	High (2.03)
SBD	12.31	Moderately weak (0.11)	Medium (7.49)
SBT	4.12	None (0.01)	High (3.47)
SO	0.59	Moderately weak (0.02)	Medium (0.11)
SVA	0.12	Absent (0)	Present (0.33)
SL	0.34	Absent (0.12)	Present (0.05)
SA	0.05	weak (0.02)	High (2.47)
SM	4.36	None (0.02)	High (2.20)
SCH	2.58	None (0.01)	weak (0.47)
SP	5.16	weak (0)	Medium (0.25)
SAR	0.56	weak (0.11)	High (3.36)
SFT	0.42	Moderately weak (0.11)	High (2.61)
SFT/SAU	13.55	Medium (0.88)	High (1.29)
SFC/SAU	2.51	weak (0.13)	High (2.04)
SFN/SAU	10.05	None (0)	Medium (1.25)

Moreover, these farms have a high level of structure and their leaders are engineers whose age varies between 47 and 65 years.

3.1.5.4 Class 4

Class nine farms (15.52%) managed by younger farmers compared to other groups with a range of 25-65 years.

With a land potential of 198.44 ha, they have an agricultural area that varies between 35 and 100 ha of which 40 ha in dry and irrigated 25.86 (average). Surfaces reserved for cereal crops amounted on average to 24.22 ha for durum wheat and 10 ha for barley. The surface portion reserved for fodder (SFT) is smaller with 20.67 ha on average; green barley, oats and natural grasslands represent 30 ha, 20 ha and 8 ha respectively. Market gardening and arboriculture respectively occupy about 4.89 and 0.78 ha on average.

3.1.5.5 Class 5

It is made up of farms (14 or 24.14%) with a legal status between EAC and Owner. Operators are of an age ranging from 47 to 84 years in whom the university level predominates. The area devoted to grain farming is prominent in these farms, or 71.33% of the SAU, which averaged 19.79 ha; the area for fodder represents only 18.20% of the SAU.

It is noteworthy that the total agricultural area of each operation of this group does not exceed 34 ha with a maximum agricultural area of 30 ha of which 26% are conducted in sec. The fallow areas are very small (0.86 ha) on average and the meadows are less than 5 ha.

The farms of this group do not really care for vegetable crops and tree; the surfaces devoted to them are weak 1.5 and 0.57 ha on average respectively.

3.1.5.6 Class 6

Smallholder vocation cereal forage combining their market gardening, they are number thirteen (13) representing 22.41% of the entire sample. They are characterized by an average agricultural area of 6.62 ha of which 68.53 conduits irrigated. In opposition and in relation to other classes, forages are an important part at the farm level thereof with surfaces up to 7 ha occupied mainly oats and barley green (4 ha), the meadows (4.5 ha maximum) but with a SFN / SAU low ratio or even zero in some farms. Vegetable crops occupy a significant place in the group with surfaces up to 2.65 ha on average while cereal has a tiny share of the UAA and marked by the total absence of soft wheat.

Livestock in this type of farms is mixed; herds are large (up to 50 head of cattle and 500 head of sheep). Poultry farming is also present with a workforce of 7,200 hens on average.

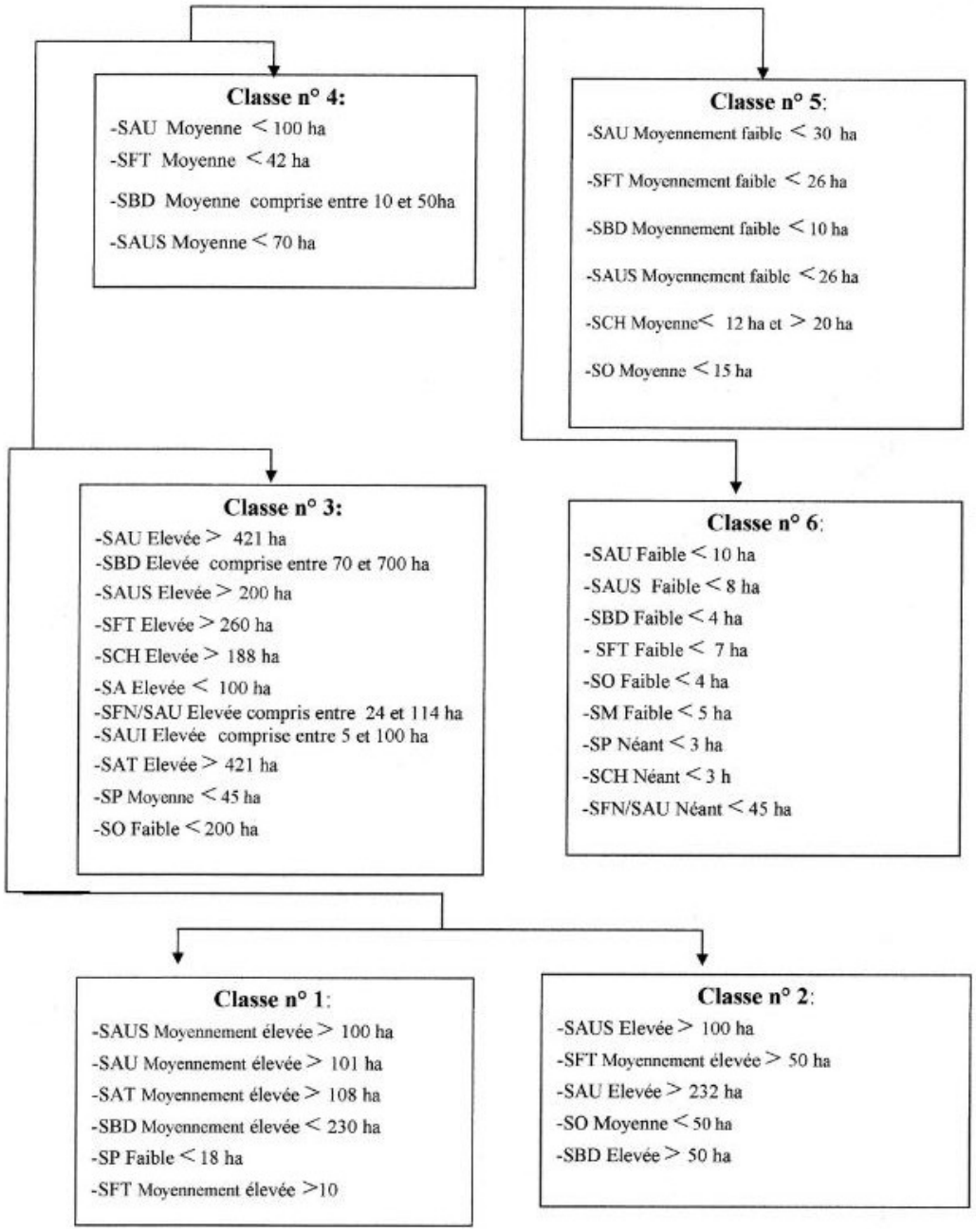

Fig. 1. Representation of the different classes of the partition with 6 classes of the typology accompanied by their characterizing variables and their modalities (2009/2010)

Fig. 3 provides a description of the "spatial" positions of terms representing the variables characterizing the partition classes studied; indeed:

- The Terms "far and high" in most of the variables that characterize the class 3 are arranged above the axis 1 and right of the axis 2.
- The Modality "moderately high" of almost all of the variables that characterize the class # 1 are located below the axis 1 and right of the axis 2.
- The Modality "moderately low" which essentially distinguishes the variables of class # 5 is located below the axis 1 and left of the axis 2

- The "Average" mode corresponding to the class # 4 is located below the axis 1.
- The modality "low" that differentiates the class 6 is disposed above the axis 1 and left of the axis 2.

From the "spatial" establishment of the modalities (Fig. 3), we can notice that their distribution is quite similar to the distribution of classes that correspond to them as shown on Fig. 2.

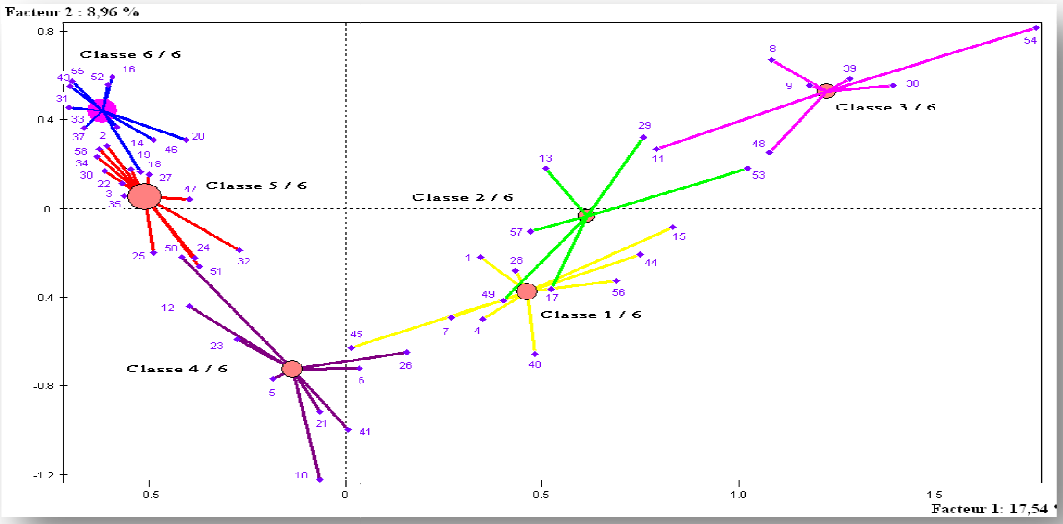

Fig. 2. Distribution of the paragons of the different classes (of the typology of the farms investigated) on the axes F1-F2 (2009/2010)

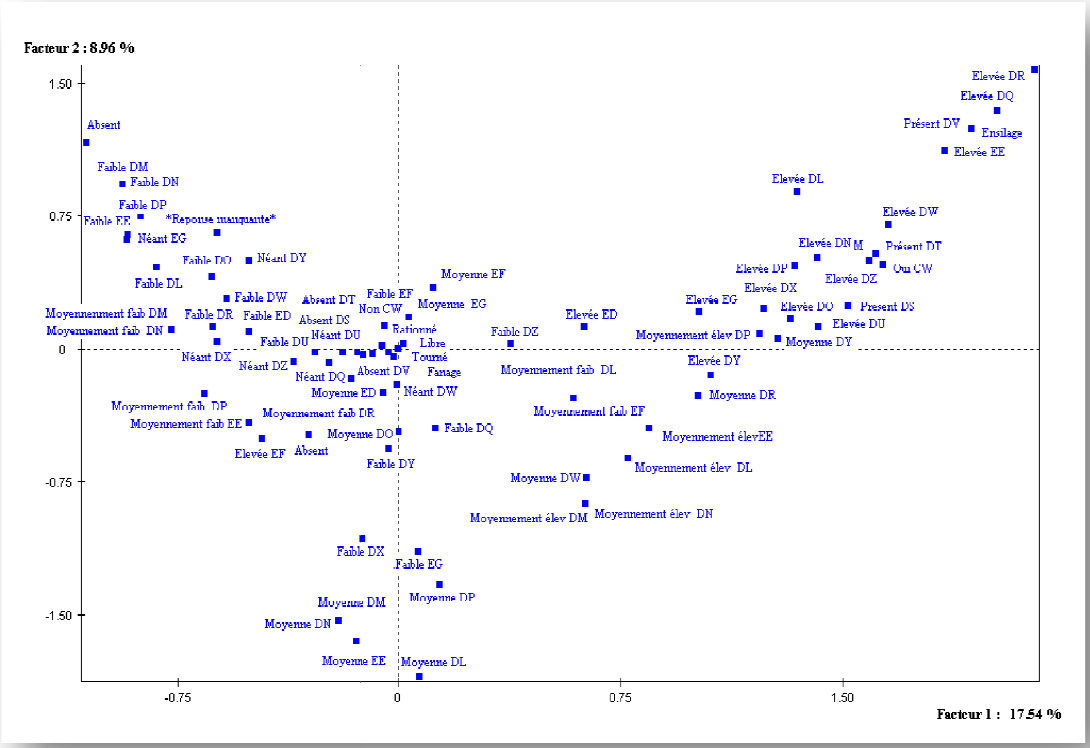

Fig. 3. Distribution of the modalities of the active variables on the F1-F2 axes (2009/2010)

3.2 Season 2010/2011

This season also the same methodological approach was adopted, as well as testing the statistical treatment. The typology conducted yielded two (02) separate partitions: The first one with three (03) classes, the second with four (04) classes including all variables (active) and their modalities.

3.2.1 Selection of variables

As well as the first sample (2009/2010) twenty-two (22) variables were retained for this season. They are: total agricultural area (SAT), agricultural useful area (SAU), useful in dry agricultural area (SAUS), useful in irrigated agricultural area (SAUI), durum wheat area (SBD), soft wheat area (SBT), Surface of barley (SO), vetch area (SV), Surface oats (SA), Surface vetch-oats (SVA), Surface alfalfa (SL), sorghum surface (SS), Surface of fallow (SCH), pasture type (TP), area of market gardening (SM), area of grassland (SP), arboreal area (SAR) conservation mode (TC), total forage area (SFT), ratio of total forage area / agricultural useful area (SFT / SAU), ratio of cultivated forage area / the agricultural useful area (SFC / SAU) report of natural forage area / agricultural useful area (SFN / SAU).

The ACM results made it possible to identify several factors (axes) being able to explain the total variance between the 61 exploitations. We chose the most explanatory axes of this variance, F1 which contributes for 19.44% and F2 for 10.59%; this gives us a total contribution of 30,03%.

3.2.2 The contribution of the active variables in the formation of the axes

Table 4 shows the contribution of the variables (SAT, SAU, SAUS, SAUI, SBD, SBT, SO, SL, SA, SS, SM, SCH, SP, SAR,SFT /SAU, SFT, SFC/SAU, SFN/SAU) in the description of the axis 1 by the following respective values (each one by its respective modality whose only minimum and maximum of contribution are represented).

On the Table 5, for the second axis (F2), the same variables (with their modalities) contribute by the following values.

3.2.3 Correlation between variables

The analysis of the variables taken in pairs allowed obtaining a matrix of correlation of which the analysis revealed that the SCH represents the prevalent fodder sources in the area of study considering the strong correlation which it has with the SAT (r = 0.976) on the level of a very important SAU (compared to the SAT) with r = 0.744 and is much more exploited in dryness (rSAUS = 0,968) than in irrigated (rSAUI =0,309).

Table 4. Contribution of active variables and their modalities in the formation of axis 1

Variables	Contribution (%)	Modality contribution (%)	
		Minimum	Maximum
SAT	1.65	Weak (1.65)	High (8.49)
SAU	1.35	Medium (1.35)	High (6.61)
SAUS	1.17	Medium (1.17)	High (6.61)
SAUI	0.24	Weak (0.24)	Medium (1.20)
SBD	0.72	Medium (0.72)	High (3.78)
SBT	0.68	Weak (0.04)	High (3.52)
SO	0.06	Moderately low (0.02)	Medium (4.03)
SVA	4.67	Absent (0.42)	Present (4.67)
SL	0.43	Absent (0.21)	Present (2.26)
SA	0.03	None (0.08)	High (1.53)
SM	0.14	None (0.22)	High (3.16)
SCH	0.12	Weak (0.01)	High (2.68)
SP	0.04	Weak (0.01)	Medium (5.37)
SAR	0.73	Weak (0)	High (2.57)
SFT	1.40	Medium (1.47)	High (4.70)
SFT/SAU	0.47	Medium (0.42)	High (2.84)
SFC/SAU	1.40	Weak (0.12)	High (0.43)
SFN/SAU	6.04	Medium (0.01)	High (0.55)
SS	0.09	None (0.09)	Medium (0.79)

Table 5. Contribution of active variables and their modalities in the formation of axis 2

Variables	Contribution (%)	Contribution des Modalités (%)	
		Minimum	Maximum
SAT	1.30	weak (1.30)	High (0.28)
SAU	0.10	weak (0.10)	High (1.13)
SAUS	1.40	weak (1.40)	High (1.13)
SAUI	0.36	weak (0.36)	Medium (1.86)
SBD	0.17	weak (0.17)	Medium (0.88)
SBT	0.09	None (0.09)	High (0.87)
SO	0.00	None (0.00)	Medium (0.01)
SVA		Absent (0)	Present (0.33)
SL	0.26	Absent (0.26)	Present (1.75)
SA	0.38	None (0.38)	Medium (0.25)
SM	0.43	weak (0.43)	Medium (0.02)
SCH	5.13	weak (5.13)	Medium (5.90)
SP	2.23	weak (2.23)	Medium (1.63)
SAR	0.20	weak (0.20)	Medium (0.00)
SFT	0.78	weak (0.78)	Medium (2.62)
SFT/SAU	3.86	weak (3.86)	Medium (6.98)
SFC/SAU	2.51	weak (1.90)	Medium (0.00)
SFN/SAU	10.05	weak (4.69)	Medium (5.51)
SV	0.76	No (0.07)	Yes (0.76)
SS	0.00	None (0.00)	Medium (0.02)

The ratio SFC/SAU is very slightly correlated with SFT/SAU (r = 0.085), negatively correlated with the SBD (r = -0.343) like with SBT(r = -0,210) and it's also negatively and very slightly correlated with the other variables; that means that the fodder cultures are almost completely absent, and when they exist, their surfaces are limited in the surveyed sample. In addition it is to be announced that natural fodder (meadows and fallow) constitute the principal fodder source of the livestock in our area of study.

3.2.4 Study of the two partitions

Hierarchical classification is represented by the raising of dendogramme which identifies two (2) possible partitions; the first one with four (4) classes and the second one with three (3) classes.

3.2.4.1 First partition (4 classes)

3.2.4.1.1 Class 1

This class contains six exploitations (9.84% of th e whole sample) belonging all to the type "model farms". The chiefs of the exploitations are engineers thus with a level of academic work, their age varies between 48 and 50 years. It is announced that average total agricultural area is of 1680.33 ha, and average useful agricultural surface is lower than 2565 ha where as the surface exploited in irrigated is lower than 202.16 ha. The operating system dominating in this group is the practice of the cereal cultures in particular the durum wheat on an average surface of 342.83 ha. Then comes the common wheat culture with 215 ha and the barley with 214.67 ha. Total fodder surface is lower than 728.33 ha. Arboriculture is present at the level of these exploitations with an average surface of 27.17 ha besides the market gardening with an average of 12.53 ha, strengthened by the ovine breeding (716 heads) and the bee-keeping (27 hives).

3.2.4.1.2 Class 2

This class is also composed of 6 exploitations (9.84%) with a legal status EAC. The medianage of these farmers is 53.5 (22 to 85 years), this class is characterized by a total agricultural surface of 269.5 ha and average level of structuring (office, hangar, cattle shed, drilling, …..); the useful agricultural surface exceeds the 173 ha on average whose surface expoited in drynessis of 163.33 ha where as the surface exploited in irrigated is lower than 10 ha. These exploitations are directed towards the cultivation of cereals, mainly the durum wheat culture with an average surface of 116.33 ha followed by the barley which emblave a surface varying between 10 and 50 ha; total fodder surface is lower than 130 ha. The grounds reserved for arboriculture

are lower than 12.67 ha where as those occupied by the truck farming do not exceed the 5 ha. In this class, one notices the presence of the illustrative variables such as the production of red meat which presents an average of 5400 kg/year.

3.2.4.1.3 Class 3

The twelve exploitations which form this class always belonging to the type EAC or to owner account for 19.67% of the total, characterized by an average total agricultural surface of137.58 ha %, their agricultural useful surface exceeds the 57.42 ha on average whose surface exploited in dryness is of 56.17 ha whereas the surface exploited in irrigated is lower than 1.25 ha. Most of the chiefs of the exploitations are of academic level. The average surfaces reserved to the cereal cultures are of 31.58 ha for durum wheat, 13.83 ha for the barley. Total fodder surface is lower than 102.46 ha on average. For the barley in green, the oats and the fallow are of 1.83 ha, 1.75 ha and 71 ha respectively. The owners of this group are not really interested in the market gardening and arboricolous, average surfaces devoted to these cultures are small, 0.5 ha and 0.79 ha on average respectively.

3.2.4.1.4 Class 4

Small holding with cereal-fodder vocation combined with the truck farming, they are 37 representing 60.66% of the whole exploitations. The median age of these farmers is of 51.5 (30 to 73), they are characterized by a low land dimension (28 ha), with an average SAU of 25.40 ha including 5.84% conducted in irrigated. Fodder occupy the least significant part with surface of 14.554 ha max: oats (1.986 ha), alfalfa (0.23 ha), vetch-oats (0.24 ha), sorghum (0.08 ha) and fallow (3.135 ha). Arboriculture is present in these exploitations with an average surface of 0.27 ha besides the market gardening with an average of 1.07 ha; the bee-keeping is also present in this group.

3.2.4.2 Second partition (3 classes)

3.2.4.2.1 Class 1

Most of the exploitations in this class are firm pilot, they are six exploitations with a percentage of 9.84%, characterized by a high useful agricultural surface (2562 ha) and a level of high structuring (office, hangar, cattle shed, drilling…). The chiefs of the exploitations are engineers; their age varies between 48 and 50 years and their principal orientation is the cultivation of cereals represented by durum wheat with an average of 342.83 ha, common wheat (215ha) and barley (114.67 ha) combined with the fodder production with an average SFT of728.33ha (44 ha for the oats, 5.83 ha for the alfalfa, 13.33 ha for the tare-oats, 1.67 ha for the sorghum and 521.5 for the fallow) from where a surface exploited in dryness of approximately 1359.83 ha and that in irrigated of 202.17 ha.

3.2.4.2.2 Class 2

Eighteen exploitations form this class belonging to type EAC and account for 29.51% of the unit; their useful agricultural surface exceeds the 98 ha on average, whose surface exploitedin dryness is of 93.83 ha whereas the surface exploited in irrigated is of almost 4 ha.

These exploitations are also directed towards the cultivation of cereals with like principal speculation, the durum wheat of an average surface of 61.33 ha then the barley which occupies an average surface of 14.17. Total fodder surface is nearly 111.86 ha. Andlike illustrative variable, the livestock production holds an important place in the characterization of this class in particular the production of the eggs (12753.3 Egg/Day).

3.2.4.2.3 Class 3

Thirty-seven exploitations compose this third and last class representing 60.66% of the total exploitations. They are managed by younger farmers compared to the other groups with a fork from 25 to 65 years (45 years on average).

The land potential of this kind of exploitations is evaluated to 24.46 ha on average, with a useful agricultural surface which varies from 35 to 100ha including 18.38% in dryness and 5.84% in irrigated. The average surfaces occupied by the cereal cultures are: 10.77 ha for durum wheat and 5.14 ha for barley. Total fodder surface rises to approximately 14.53 ha on average. For the barley in green and the oats, they respectively occupy 1.28 ha and 1.99 ha. The market gardening on average have a considerable place in this group of exploitations with surfaces going up to 1.20 ha.

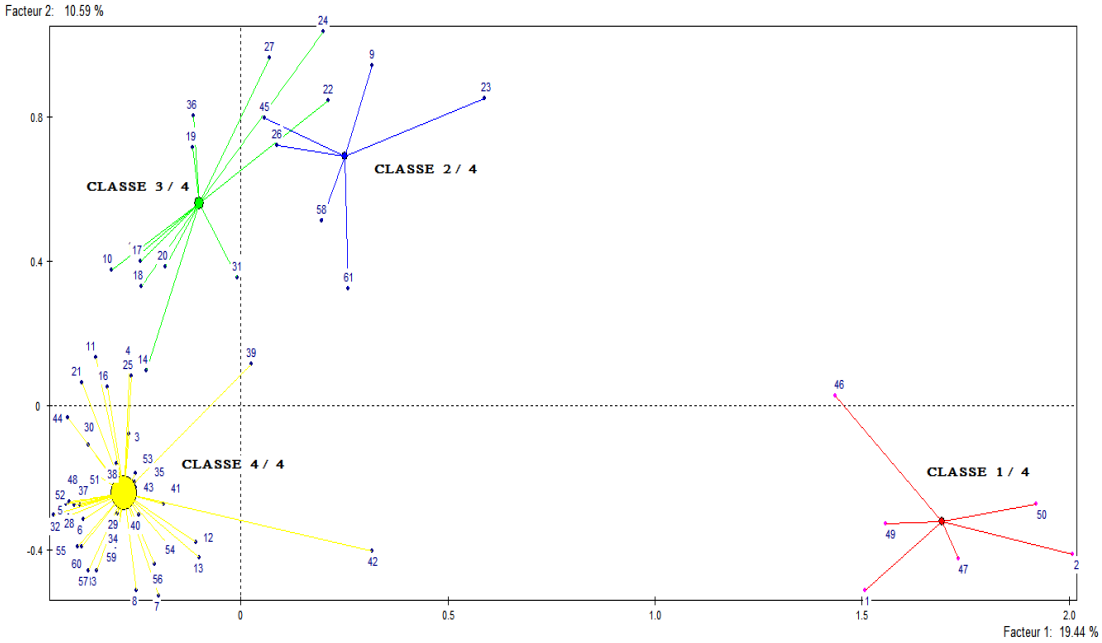

Fig. 4. Distribution of the paragons of the different classes of the first partition of the typology on the F1-F2 axes (sample II)

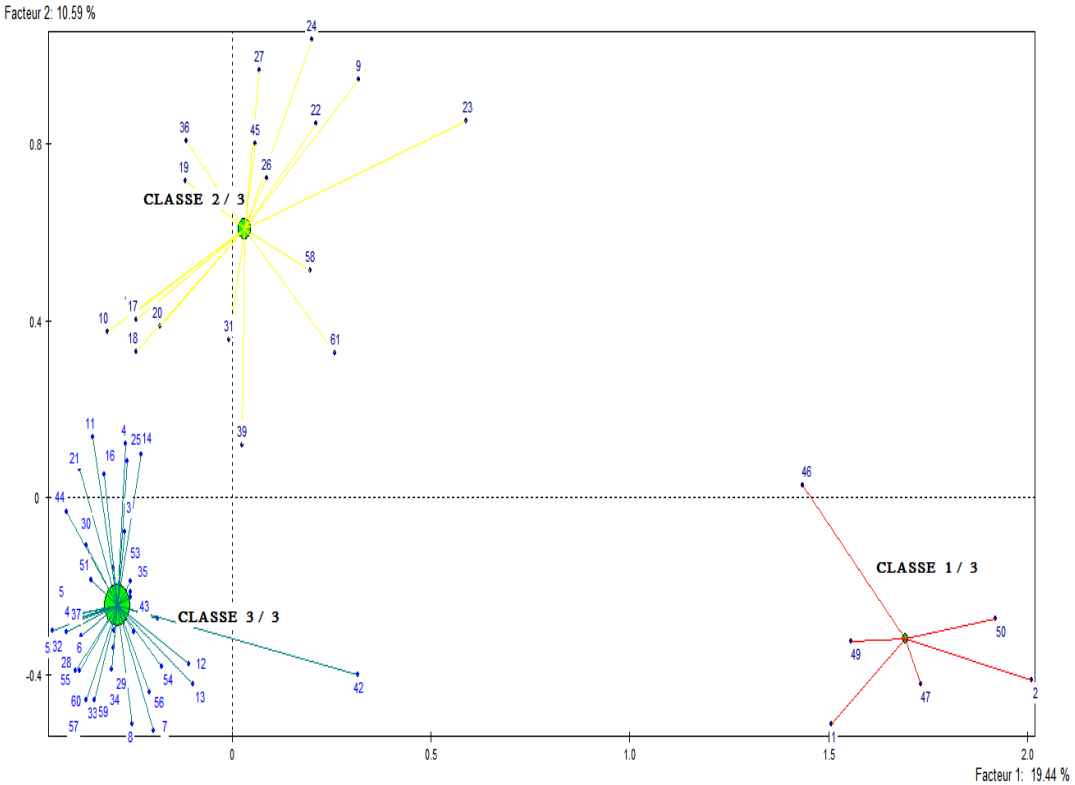

Fig. 5. Distribution of the paragons of the different classes of the second partition of the typology on the F1-F2 axes (sample II)

Finally and after characterization of the various groups of exploitations, we were able to affirm that they are the exploitations of the first class for the two partitions (1/4 and 1/3), which are richer compared to the others owing to the fact that it includes model farms and EAC who hold the largest surfaces and practise diversified cultures (cereals, truck farming,…). The exploitations of the second classes (2/4 and 2/3) are EAC with more or less high surfaces directed towards the cultivation of cereals mainly the durum wheat culture. The farm equipment relating to the work of the ground and the mowing; the disc harrow, the plough (with ploughshare, disc), the roller, the reaper, the farmer and the spreader of manure are specific to the farmers. The third classes (3/4 and 3/3) contain exploitations with average or more or less low surfaces but with different orientations surfaces going up to 1.20 ha on average.

Figs. 4 and 5 represent the distribution in space (on axes F1-F2) classes of each partition (partition with 4 classes and partition with 3 classes respectively); we note that their positioning compared to the two axes F1 and F2, agree perfectly with the distribution of their respective methods represented on Fig. 6 which allows the description of the two-dimensional position of the modalities representing the variables characterizing the classes of each studied partition; indeed:

- The “high or large” modality and the modality “yes” of the more share of the variables which characterize the classes (1/4 and 1/3) are laid out below axis 1 and on the right of axis 2
- The “Average” modality of the near total of the variables characterizing the class (2/4 and 2/3 as 3/4) is above axis 1 and on the right of axis 2.
- The “weak” modality which distinguishes the classes (4/4 and 3/3) is below axis 1 and on the left of the axis 2.Going up to 1.20 ha on average.

Fig. 7 represents the modalities of the active variables characterizing each class of the two studied partitions.

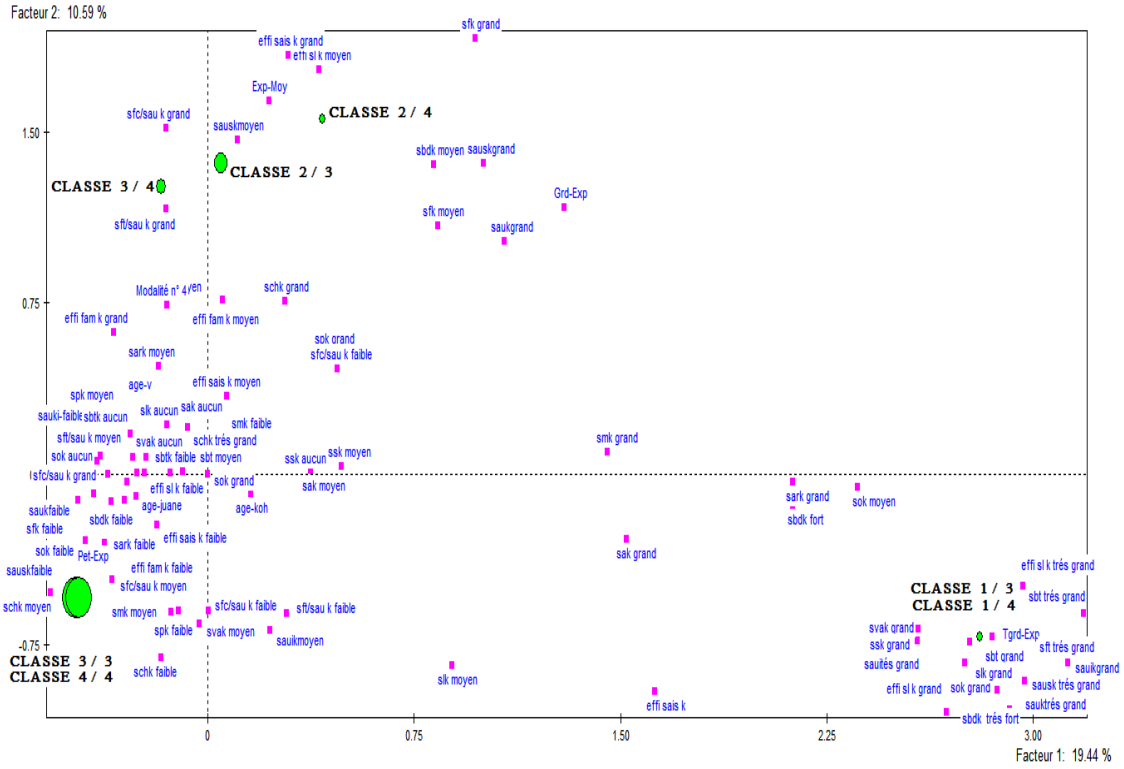

Fig. 6. Distribution of the modalities of the active variables on the F1-F2 axes for the classes of the two partitions with their modalities (2010/2011)

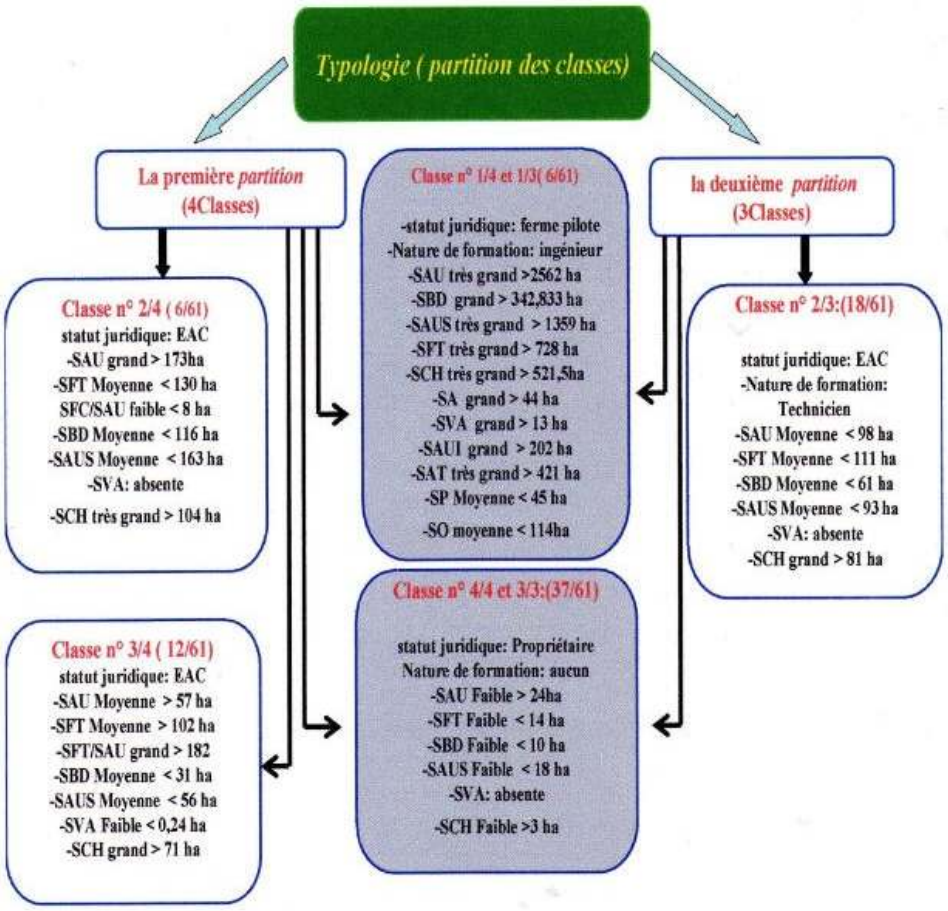

Fig. 7. Representation of the different classes of the two partitions of the Typology accompanied by their characterizing variables and their modalities (2010/2011)

The analysis of the situation of forage resources (cultivated and natural) in the semi-arid region of Sétif allowed us to discuss a general approach to the forage sector in this region. We found that forage crops are secondary agricultural activity in the majority of farms in the study area.

In fact, we have been able to point out a certain diversity on these farms, this diversity is mainly due to the structure, the legal status, the land dimensions and the financial potentialities. In terms of legal status, there are generally five types Property; EAC (between 36 and 38%), EAI, state farms (pilots), owners and renters.

The average age of the farmers consulted is of the order of 53-55 years, it follows that the practice of agriculture in the semi-arid region of Setif is adopted by farmers more or less old basing largely on their know-how (personal experiences) than on modern techniques knowledge; Indeed the results obtained show a low involvement of young people (not exceeding 40 years), still indicating an interest in this activity, ie 8.62%, which split into the second season of study, which indicates an increase in interest in this activity.

For large and medium-sized farms, the level of capital employed is high and the use of casual labor is very high especially at the level of large farms because of the importance of seasonal agricultural work.

The analysis of the structural and functional organization of each farm revealed the existence of various practices related to the gradient of aridity, most often also in coherence with the structural dimension of the unit: The level of structuring of the farm is related to the size of the SAU: larger is the size of the production unit, greater is the level of other structural parameters

(agricultural equipment, buildings, ….. etc). The studied production units located in a climatically semi-arid zone seem to develop a Functioning characterized by the diversification of agricultural activities, although the production system is largely dominated by cereals and livestock.

The diversity of agricultural activities on farms is greater in the most structured and developed farms. It also appears to be an appropriate means of organizing production systems in semi-arid areas.

The practice of cereal crops obeys at a cereal-fallow rotation, and the area devoted to them explains the importance of these crops in relation to the production system.

Other crops are combined with cereals, the fodder of which is mainly intended for animal feed, the main mode of conservation of which is tedding with only 3.44% of farms preferring silage.

The area of forage crops varies according to the size of the holding, several forage crops can exist, such as: oats, sorghum, and barley used in green in spring and even summer, and alfalfa. However, we noticed a low interest in the cultivation of vetch despite its importance and its nutritional value [10], only 7.54% of the farms for both samples used it in combination with a cereal (oats) in very small areas (2.54 ha on average). In this region, compared to fodder crops, the area reserved for vetch is very low and represents about 1%, and in relation to the useful agricultural surface, it is not devoted to more than 0.6%.

Added to this, natural fodder, which contribute largely to animal feed, represented mainly by fallow (mowed, grazed), which is the most important natural source in addition to the large areas devoted to it for the two samples studied (83 ha on average).

The practice of fallow is linked to the fallow-cereal-livestock production system which is widely used and remains a free and safe feed for the farmer, independent of climatic disturbances. Fallowing makes it possible to graze the stubble in summer and the weeds from autumn to spring.

From the point of view of production, the grasslands which are improved by irrigation (wadis, hill reservoirs, etc.), especially in the northern part of the study area, produce more in quantity than in the South. Compared to the aridity level, significantly higher yields are obtained in the northern part of the region where rainfall is high and the management mode is different. Indeed, the early protection of hay meadows (early winter), fertilization, weeding and permanent irrigation, allow higher yields in the North compared to farms in the South.

However, the share of irrigated areas of the total SAU in the farms visited for each of the seasons studied represents respectively only 12.5%. This can be explained by the lack of water resources on the farms and, consequently, irrigation of land is conditioned by their water potential. Indeed, the main irrigated crops are summer fodder, market gardening, and sometimes cereal farming. Irrigation therefore depends on the area, water resources, the nature of crops and the technical and financial means available to farmers.

Animal production workshops play a complementary role on farms, with livestock being associated with cereal farming. Cattle's breeding in our case is less controlled and most of the investment effort is directed at controlling and increasing the ovine sometimes associated with it or goat but rarely goats with cattle; this shows the reserved place to the sheep in the economy of these farms and possibly in the agricultural production systems of our region In contradiction with the structure of the farms which varies according to the agro-ecological zones; (72%) in the coastal zone, by the sheep / cattle association in the cereal and sublittoral zones, sheep in the steppe zones (75%) and camels in the Saharan zones (56%) as advanced by [11]. Sheep are present in more than 80% of the farms surveyed for both seasons; In fact we noticed a significant difference between the zones of the study area and between the farms of the same zone for the criterion "effective of the herds".

Livestock feeding is based on coarse feed in the form of cereal straw, oat hay or meadow complemented by concentrate. These dry forages are distributed throughout the year or during the winter period, the quantities of which vary from one farm to another and from one season to another.

The typological approach made it possible to identify six classes in the first sample (2009/2010) and three/four classes in the second sample (2010/2011), which differ significantly

from one another. The third class is the highest with an average of 919.14 ha, the second is slightly lower (330.66 ha), followed by the first class, which represents a moderately high area (147.47 ha), the fourth class is medium (53.88 ha), the fifth class is moderately weak (19.78 ha), the sixth is weak (6.61 ha).

The elaboration of a typology of agricultural holdings in the study area made it possible to highlight an elite among the sample composed of classes number 3.2 and 1; However, a very important point emerges from this study concerning all the farms, namely the deficiency of fodder resources, especially cultivated fodder such as alfalfa, sorghum, etc., which have a deficit of 84.48% and more particularly of the kind *Vicia* which is practically absent recording a weak presence of 7% compared to the samples.

4. CONCLUSION

The problems of the sustainable development of the systems of breeding in Algeria, fall under the mode of resolution of the question growing variation between fodder offer and needs for an animal livestock growing. The analysis of the results has made it possible to note that the fodder cultures take a little part in the food of the livestock compared to bought food and the spontaneous resources. Indeed, the problem of the contribution of artificial fodder are closely related to the absence of a true strategy concerning the production of seeds, causing a very reduced diversification of the cultivated species and correlatively a very modest contribution of the local cultivars.

The adverse conditions of the climate also contribute to it for a certain share. The realization of the typology of our two seasons samples of farms, made it possible to visualize a prototype of exploitation characterized by the same legal status (owner) and by the farming with knowing association of the breeding (ovine especially) with the cultivation of cereals and mainly durum wheat. An homogeneous fodder situation at practically all the exploitations since all these last, are on one hand equipped with low surfaces devoted to the fodder production as well for the natural resources as for the artificial resources and on the other hand they carry in general, a very timid interest compared to this kind of activities. In a general way, the non financial profitability of the fodder cultures comes from the high price of their seeds which cost on average ten times more than the non fodder seeds but also from the hydrous stress caused by the rainfall pause recorded all these last years. Added to those other major difficulties of adoption of the fodder cultures which are of three orders:

- The land problem.
- The problem of time in the farming calendar.
- The problem involved in the availability or the production of seed.

At the end of this analysis of the situation of the fodder resources in our area, we propose that the exemplary solution to improve the food of the animals is the following recommendations:

- Improvement of the natural courses by the introduction the graminaceous ones and fodder, herbaceous or woody leguminous plants for better making up the food deficit of the animals.
- To be much more interested in the fodder cultures by the use of leguminous plants and in particular of the vetches (tares), on fallow which should be able to improve the food of the herds.
- The encouragement of the production and the marketing of fodder seeds.
- The encouragement of the use of the local ecotypes already used by certain farmers such as the sullas, the tares, the lathyrus, fiel pea and the sorghum.
- Need for re-examining the way of managing expitation and use of natural meadows and the courses by their regeneration taking into account their roles I the fodder calendar.
- Introduction of the culture of new species and varieties after selection preferably, within the local genetic resources naturally better adapted to thr conditions of the medium.
- To support, for the rain cultures, of fodder species more productive than those which are cultivated traditionally (oats and tare-oats).
- Selection for the culture in irrigated, of the less consuming species, in order to reduce competition between fodder cultures and market gardening or fruit-bearing arboriculture on a space and for very reduced availabilities out of water.
- And finally, the creation of a data bank (production, needs, seeds, price and importation).

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Abdelguerfi A. Place des légumineuses dans la valorisation de l'espace agricole et pastoral en regions nord d'Algérie, Diversité des fabacées fourragères et de leurs symbiotes: Applications biotechnologiques, agronomiques et environnementales˝, Workshop int., Alger A. Abdelguerfi éd., 2006;309-320.
2. Belaid D. Aspect de la céréaliculture Algérienne˝. OPU, Alger. 1986;6-28.
3. Nedjraoui D. Profil fourrager. 2012;26-32.
4. Abdelguerfi A. Quelques réflexions sur la situation fourragère et pastorale en Algérie, Séminaire sur la constitution des réseaux thématiques en recherche agricole au Maghreb. Rabat, Maroc. 1988; 75-78.
5. A. Mebarkia, Abdelguerfi A. Etude du potentiel agronomique de trois espèces de vesces (*Vicia spp.*) et variabilité dans la région semi-aride de Sétif (Algérie); 2007.
6. Hamadache A. Les ressources fourragères actuelles en Algérie situation et possibilité d'amélioration in actes de l'atelier national sur la stratégie du développement des cultures fourragères en Algérie Ed. ITGC. 79.
7. SPAD software (Copyright @ Decisia 1996-2002) for Windows.
8. Mottet A. Transformation de systèmes d'élevage depuis 1950 et conséquences pour la dynamique des paysages. Contribution à l'étude du phénomène d'abandon de terres agricoles en montagne à partir de l'exemple de quatre communes des Hautes-Pyrénées. Thèse présentée pour obtenir le titre de docteur de l'institut national polytechnique de Toulouse. 2005;263.
9. Hostiou N. Pratiques et stratégies de gestion des ressources herbagères cultivées par des ´éleveurs laitiers sur un front pionnier en Amazonie br´esilienne: cas du municipe de Uruar. Other. Institut national agronomique paris-grignon - INA P-G ; 2003. (French)
10. Haj Ayed M, González J, Caballero R, Remedios Alvir M. Effects of maturity on nutritive value of field-cured hays from common vetch and hairy vetch, Anim. Res. 2001;50(1):31-42.
    DOI:http://dx.doi.org/10.1051/animres:2001103
11. Adem R, Ferrah A. Les ressources fourragères en Algérie: Déficit structurel et Disparité régionale, analyse du bilan fourrager pour l'année; 2001, 2002.
    Available:http://www.gredaal-com/contact-formulaire.htm

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