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Situation of Forage Crops Intended for Feeding Dairy Cattle in Some Breeding Farms in the Wilaya of Blida (Algeria)

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ABSTRACT

Background: Forage crops in Algeria are deficient and thus constitute the primary obstacle hindering milk production. The present study aims to assess fodder practices in the wilaya of Blida, through the farms surveyed.

Methods: A chronological and spatio-temporal analysis of the evolution of areas, fodder and dairy production, a survey of 76 dairy farmers and a descriptive analysis by quantiles of key variables using statistical tools (Excel and SPSS) was performed at the level of the of Blida province. A database is established using information collected from the various agricultural services of the wilaya of Blida and the examination of questionnaires from surveys carried out in the dairy farms visited.

Result: The proportions by quantiles allowed discerning that two thirds of the farmers visited allocate areas of 0 to 20 hectares to fodder. With regard to a utilized agricultural area between 0 and 140 hectares, of which up to 110 hectares are allocated to cereals and the rest of the land allocated to other crops such as fruit trees. The farmers surveyed rely more on cereal crop residues to feed dairy cattle and practice little or no forage crops, which explains the delay in the development of dairy production.

Key words: Blida, Dairy cattle, Dairy farmers, Forages, Investigation.

INTRODUCTION

In the field of animal feeding, fodder occupies an important place and particularly for ruminants, even more in dairy production, the culture of fodder is an important link in the production chain (El Hassani, 2013). Indeed, a lack of fodder in the diet of dairy cows has a negative impact on their health, profitability and production costs (Boukhechem *et al*., 2019).

According to Houmani (Houmani, 2005), dairy cattle farming in Algeria is characterized by the excessive use of dry hay and concentrates, to the detriment of green fodder and silage. Thus, cultivated forages contribute little to the diet of herbivores and their seeds are imported (Bencherchali, 2018). Animal husbandry is carried out in a traditional way by exploiting natural rangelands and meadows, often of poor quality, fodder crops are used very little and the protein needs of the population depend on imports (Hamrit, 1995).

Indeed, the situation of the milk sector in Algeria is characterized by a significant dependence on imported milk powder. According to USDA statistics, Algeria imported between 8 to 10% of the world supply of milk powder between 2016 and 2019 and thus becomes the fourth world importer after Mexico, China and Indonesia (USDA, 2020).

As a result, the development of the dairy sector in Algeria is of great concern to the Public Authorities, whose major concern is to develop milk production in our country in order to reduce imports of milk in all its forms. However, this insufficiency of fodder resources constitutes an obstacle to the development of cattle breeding in Algeria. Note that for annual needs estimated at around 10.5 billion fodder units (UF), the availability is on average only 5.2 billion fodder units, ie a coverage rate not exceeding 50% (Chehat, 2001). This is indeed one of the main findings noted for our case study, the wilaya of Blida, where the areas allocated to fodder crops equivalent to 6,401 hectares in 2018, only occupied 11.4% of the useful agricultural area of 55,780 hectares (MADR, 20119), despite the relatively large number of cattle estimated at around 15,899 heads, including 11,795 dairy cows, recording a milk production of 50,969,000 liters in 2018 (DSA, 2018). This milk production remains dependent on low fodder production, ie only 648,125 quintals during the same agricultural year (DSA, 2018).

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The analysis of the situation relating to the weakness of fodder production in the wilaya of Blida during the period 2009-2018 has, to our knowledge, been the subject of very few studies. This analysis is all the more effective as it corresponds to groups of homogeneous farms (results of the quantile analysis). This paper aims to help identify the evolution of the fodder situation in a central region, moreover in the Mitidja and which represents an agricultural area of primary importance at the national level through a spatio-temporal analytical study, which will provide a vision of the local situation, highlight the particularities of existing types of dairy farming, identify strengths and weaknesses and thus recommend recommendations for dairy farmers.

MATERIALS AND METHODS

Presentation of the study region

The wilaya of Blida, with an area of 147,862 km^2, is located in the north of the country in the central Tell (36°28′ 00″ N, 2°49′ 00″ E) and it is delimited to the north by the wilayas of Algiers and Tipaza, to the east by the wilayas of Boumerdès and Bouira and to the south by the wilayas of Médéa and Aïn Defla (Fig 1).

The relief of the wilaya mainly consists of an important plain (the Mitidja) as well as a mountain range to the south of the wilaya (area of the Blidéen Atlas and Piedmont) (CACI, 2020). The Mitidja plain is an agricultural area rich in citrus orchards, vineyards and other fruit trees in addition to beekeeping and industrial crops, as well as cereals which occupy large areas and sometimes crops. Fodder are practiced there. The Atlas area Blidéen and the piedmont, the central part of the Atlas, culminates at 1600 meters. Very steep slopes (greater than 30%) are subject to intense erosion, where forest cover is lacking. Only the foothills, altitude varying between 200 and 600 meters, presents favorable conditions for agricultural development. Rainfall is generally higher in the mountains than in the plains. Precipitation is most important during the months of December, January and February. The climate is Mediterranean with an average temperature of 11°C in winter and 33°C in summer (CACI, 2020).

Methodology

A survey of 79 dairy farms in different municipalities in the wilaya of Blida was carried out during the period between February 15, 2018 and May 15, 2018, in order to describe the fodder situation. An empirical, spatio-temporal analysis of the evolution of the selected variables relating to the fodder system and dairy production during 2009- 2018. In the second step, a survey questionnaire related to the human, social and economic aspect as well as dairy farms management was developed. After gathering the necessary information from the Ministry of Agriculture and Rural Development (MARD) and the various agricultural adminsitration [Directorate of Agricultural Services (DSA), Chamber of Agriculture, Agricultural Subdivisions] and especially DSA of Blida, we constituted a representative sample of dairy cattle breeders for this study.

RESULTS AND DISCUSSION

Agricultural areas and fodder inputs

Agricultural areas

The total agricultural area (TAA) of the wilaya of Blida is on average 67,067 ha between 2009 and 2018 (Table 1). The useable agricultural area (UAA) averaged 83.5% of the SAT over the same period (2009-2018). The irrigated useable agricultural area reaches on average 27,814 ha, which represents a rate of 51% compared to the total UAA (Table 2). The rest of the useful agricultural areas (UAA) are exploited in dry conditions during the analyzed period (DSA, 2018). However in the semi-arid region of Setif, the fodder sole in green has clearly increased compared to that cultivated in the dry, the natural meadows as well as the bare fallows have stagnated during the last 20 years (Abbas, 2014).

Forage productions

Agriculture is the essential vocation of the wilaya of Blida with the plain of Mitidja, its very fertile lands and with a total agricultural area (TAA) which represents an average of 67,067 ha during the period analyzed (2009-2018), of which 83.17% are UAA (56,018 ha), with 49.65% irrigated (27,814 ha). The data concerning the evolution of the fodder areas by municipality, noted that despite this areas remains small compared to the available UAA, varying between 2009 and 2018, mainly because of the increase in the number of animals, which causes overgrazing and hence the degradation of fodder soles (Kaouche-Adjlane *et al*., 2015).

The municipalities located in the center of the province devoted less land to fodder crops, which could be explained by the choice of farmers for fruit trees (example of the municipality of Bouinan). Note citrus growing is present in the plains located mainly in the central Mitidja (Bencherchali and Bouras, 2018), also the extension of urban fabrics at the expense of agricultural land, contributes to this decline in fodder areas (Fig 2). Our results confirmed what has already been reported by Kaouche-Adjlane *et al*. (2015). The municipality of Larbâa is known for its cattle market, which explains why the farmers of this municipality allocate relatively large areas for fodder crops. The latter, in addition to providing green food for their cattle, ensure sales for breeders in other municipalities and even in other wilayas of the country (Fig 3). Fodder productions recorded in the various municipalities of the wilaya of Blida during the period from 2009 to 2018 remained dependent on the areas allocated to relatively low fodder and on climatic conditions (Fig 4).

Status of cattle and dairy cattle

The numbers of cattle in general as well as those of dairy cattle registered a positive evolution compared to those that

preceded them, with rates of 45 and 29% respectively for 2009 and 2018 (Table 3, Fig 5). Modern dairy cattle (BLM) have seen little to very little evolution compared to improved dairy cattle (BLA) and local dairy cattle (BLL). In semi-arid region of Setif, the number of cows, especially those of imported European breeds (BLM), increased by +300%, as did milk production (+350%) while the number of ewes remained constant (Abbas, 2014).

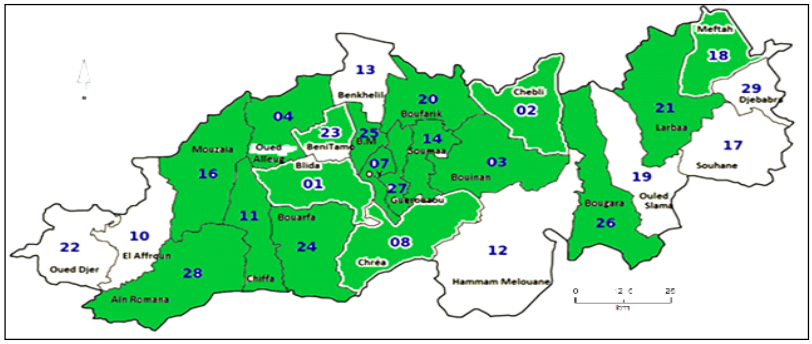

Fig 1: Geographical location and distribution of dairy farms surveyed by municipality of the wilaya of Blida (DSA, 2018).

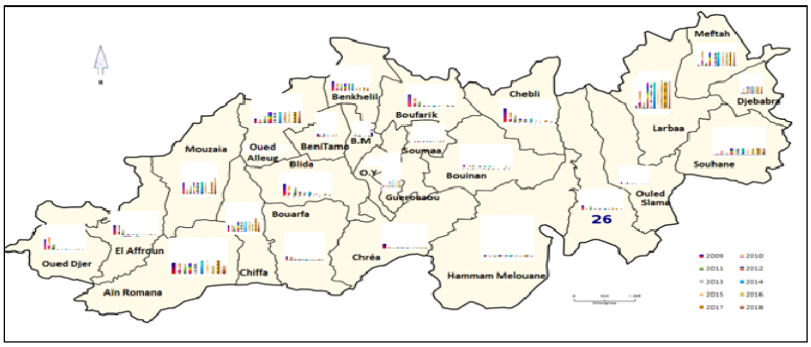

Fig 2: Distribution of fodder areas by municipality between 2009 and 2018 (DSA, 2018).

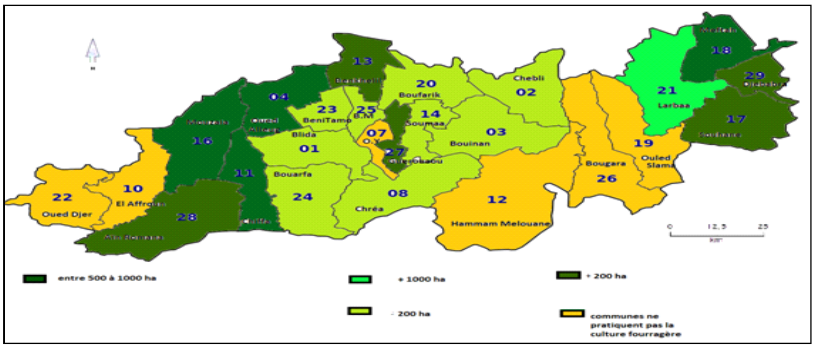

Fig 3: Fodder areas per municipality in the wilaya of Blida during the 2018 agricultural season (DSA, 2018).

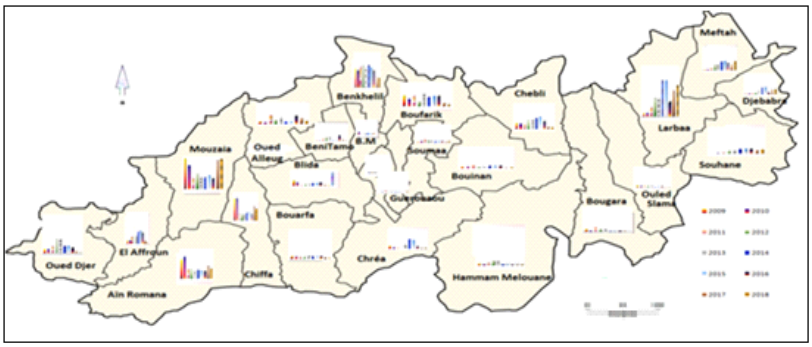

Fig 4: Evolution of fodder production by municipality (wilaya of Blida), from 2009 to 2018 (DSA, 2018).

Table 1: Evolution of the total agricultural area (TAA) and the useful agricultural area (UAA) during the period from 2009 to 2018 (DSA, 2018).

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
TAA	67,474	67,474	67,474	67,474	67,669	67,474	69,237	61,449	67,474	67,474
UAA	56,730	56,730	56,730	56,730	56,730	56,730	55,780	55,780	55,780	55,780
IUAA	28,927	28,927	28,927	28,810	30,816	31,160	3,023	31,840	31,840	32,280
UAA dry	27,803	27,803	27,803	27,920	25,913	25,570	24,757	23,940	23,940	23,500

Unit: ha; Source: DSA of Blida, 2018.

Table 2: Calculation of the statistical parameters of the useable agricultural area (UAA) (DSA, 2018).

Parameters	Minimum	Maximum	Mean	SD
UAA (1)	55,780	56,730	56,018	475
UAA in dry	23,500	27,920	25894,981	1 819,70
UAA irrigated (2)	28,810	32,280	27,814	1 407,40
% de (2)/ (1)	52%	57%	51%	296%

Table 3: Rate of change in cattle numbers in the wilaya of Blida from 2009 to 2018 (DSA, 2018).

Number	Year		Rate of evolution
(Unit =Head)	2009	2018	from 2009 to 2018)
Cattle	15,899	23,295	45%
Dairy cow	9,141	11,795	29%

In South African context, In this context, cattle production has increased by 37 000 heads from 13.5 million in 2004 to 13.87 million in 2011 (Molefi, 2017).

Dairy cattle experienced an increase in number during the period analyzed, mainly due to massive imports of heifers as part of the development of the dairy sector, on the other hand the weak evolution recorded for the BLM compared to the BLL and BLA, would probably be caused by poor breeding behavior, which slows down the renewal of the herd (long calving interval) and the culling of less performing cows, especially in periods when the feed becomes insufficient to cover the needs of cows for high production performance in order to minimize financial losses, thus keeping females with reproductive problems considerably increases the burden on the breeder (Kaouche-Adjlane *et al*., 2015). On the other hand, the wilya of Souk Ahras located on the sub-littoral has 5,500 breeders exploiting 50,200 cows including 9,000 of imported breeds with high genetic potential, 12,200 crossbred cows and 29,000 cows of local breeds (Yozmane, 2019).

Dairy production situation

Milk production decreased in volume during the period analyzed, dropping from 61,287 liters in 2009 to 50,969 liters in 2018 (Table 4). The communes of Mouzaia and Chiffa recorded the highest milk production between 2009 and 2018.

The municipality of Larbâa achieved relatively good production between 2009 and 2018. While other municipalities such as Ouled Yaïch, Chréa, Oued Djer and Souhane recorded low milk production (Fig 6).

In developed countries, a dairy cow produces an average of 28 liters of milk per day and productions can reach during peak lactation up to 60 liters per day (CIWF France, 2020) while the bovine capital of the wilaya of Blida, which counted 11,795 dairy cows in (DSA, 2018), allows only an average production of 11 liters per day and per cow, which could be explained by an obvious insufficiency in the fodder diet of dairy cattle. This average production was only noticed in the farms where the number of herds is less than 5 (Boukhechem *et al*., 2019). The descriptive analysis by quantiles, have allowed us to note that the first decile (10%) of the farms surveyed practice soil-less breeding (TAA = 0), this observation has already been noted for some others wilayas of the country, Guelma (Kalli, 2011) and Bejaia (Belkheir *et al*., 2011).

Characterization of the farms surveyed

The results obtained showed that the number of workers varies from 0 to 8 and the average number is 2±2 workers. A great heterogeneity in the distribution of the agricultural areas of farms is noted (UAA vary from 0 to 140 ha and the fodder areas vary from 0 to 20 ha). The 76 farms surveyed have an overall UAA of 2,028 ha, of which: 394 are allocated to fodder (19.4% of the UAA) and 41.3% for cereals. In fact, the average area devoted to fodder crops is of the order of 5.18±6.17 ha and that allocated to cereals is 11.03±18.38 ha. For livestock, the farms surveyed hold a total herd of 1,266 head of which: 410 dairy cows (32%), the average number of dairy cows for the total of the farms surveyed is 5.46±1.91 heads. The production of raw milk per farm surveyed and per year is on average 32,331.31±12,568.05. The total production recorded is around 245 7180 liters for all the farms surveyed (Table 5). Due to insufficient fodder, daily milk production varies between 15 and 25 L per cow, while international standards vary between 40 and 65 L per day (Yozmane, 2019).

Descriptive analysis by quantiles of key variables

The results obtained by analysis by quantiles (D'haultfœuille and Givord, 2014) showed that 10% of the farms surveyed practice indoor breeding (TAA = 0). For each 10% farm, we find 3 dairy cows out of a total bovine of 13 heads with a stable capacity of 15 heads. The number of workers per farm does not exceed one permanent worker. Milk production per year is around 16,680.50 liters per farm. The quantile analysis showed that if we go to 20% of the farms surveyed, we will find that the latter are also characterized by the total absence of total agricultural areas (TAA),

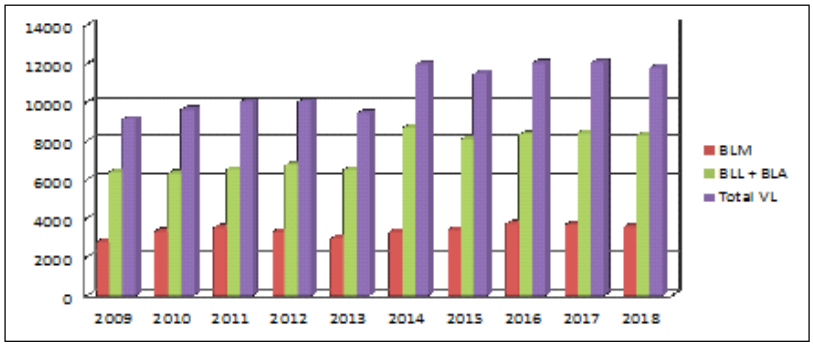

Fig 5: Evolution of the dairy cattle population in the wilaya of Blida from 2009 to 2018 (DSA, 2018).

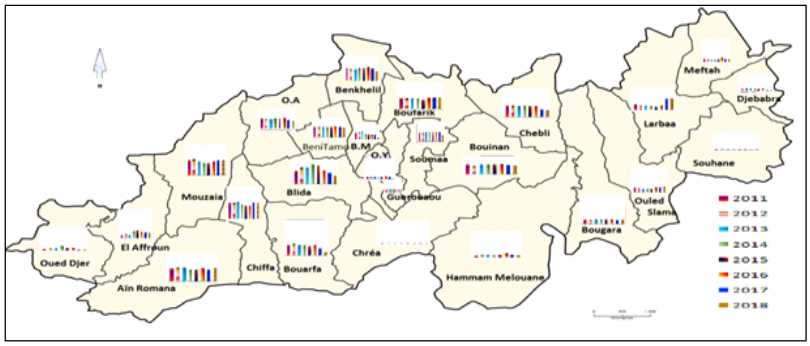

Fig 6: Evolution of milk production by municipalities in the wilaya of Blida from 2009 to 2018 (DSA, 2018).

Table 4: Evolution of milk production in the wilaya of Blida from 2009 to 2018 (DSA, 2018).

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Prod	61,287	60,124	60,147	60,911	62,216	62,525	60,159	63,152	59,565	50,969

Prod: Raw milk production; Unit: 1000 L.

Table 5: Characteristics of the farms surveyed (n = 76) in the wilaya of Blida.

Variables		Mean	Median	SD	Mini-mum	Maxi-mum	Sum
Total agricultural area (TAA)	Unit (ha)	31,89	20	34,18	0	160	2 424
Useable agricultural area (UAA)		26,68	16	30,20	0	140	2 028
Cultivated forage area (CFA)		5,18	3	6,17	0	20	394
Barn capacity (CAP)	Unit:Head	18,34	18,5	3,39	10	26	1 394
Cattle number (EFB)		16,65	16	3,47	6	25	1 266
Dairy cattle number (DC)		5,46	5	1,91	1	11	410
Total dairy production (PROD)	Unit : Liters	32331,31	30660	12568,05	5840	73000	2457180

the number of dairy cows is 4 heads out of a cattle total of 14 heads, the same number of workers recorded for 10% and an annual milk production slightly higher than that recorded for farmers in the lot of the first decile (10%) of the total surveyed and reached per year and per farm 23 360 liters. By adding 30% to go to 50%, *i.e*. the median of our sample, we observe a difference with the two percentages studied since farmers have a total agricultural area (TAA) per farmer of 10 hectares, of which 3 hectares are devoted to forage crops (Fig 7). We record for this batch of farms a number of 5 dairy cows out of 16 head of cattle per farm and a barn capacity of 17 heads, the number of workers can be two permanent workers per farm. 70% of the farmers surveyed devote 8 hectares of their farmland to fodder crops for a number of cattle of 18 heads, including 6 dairy cows, which produce up to 36,500 liters of milk per year (Fig 7). While for the last decile represented by 90% of the farms surveyed, obtained thanks to the quantile analysis, we observe that the farmers devote 15 hectares to fodder crops, they have a maximum of 8 dairy cows per farm and 22 heads of total cattle. The barn capacity being 23 heads and the milk production per year recorded for this batch of 90% of farmers is around 46,720 liters per farm and per year (Fig 7).

The statistical analysis by quantiles, also allowed us to observe from Table 6, that the areas granted for fodder crops are clearly lower than the areas allocated to cereals for the different lots, also these fodder areas are relatively very low compared to the UAA and may even be zero as we recorded for the first lot obtained.

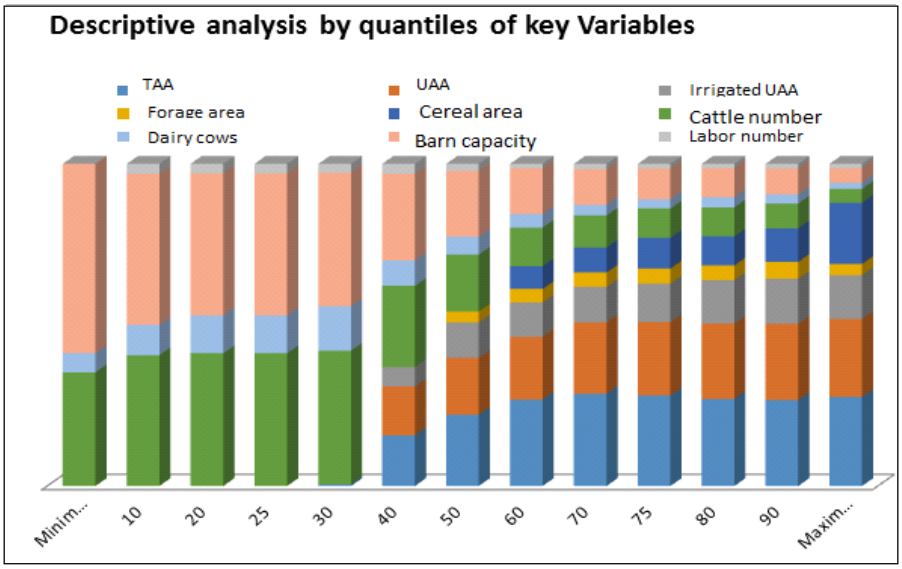

Fig 7: Descriptive analysis by quantiles of key variables.

Table 6: Differences in the most important agricultural areas by quantiles (Unit: hectares).

	TAA	UAA	Irrigated UAA	Forage area	Cereal area
Minimum	0	0	0	0	0
10	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00
30	0.20	0.00	0.00	0.00	0.00
40	10.00	9.60	3.80	0.00	0.00
50	20.00	16.00	10.00	3.00	0.00
60	38.00	27.60	15.00	6.00	10.00
70	51.80	40.00	20.00	8.00	14.00
75	58.75	47.50	25.00	9.75	20.00
80	60.00	51.80	30.00	10.00	20.00
90	76.50	67.90	40.00	15.00	30.00
Maximum	160	140	79	20	110

Coefficient of variation

The most significant variation of 166% concerns cereal areas, followed by the practice of irrigated crops (120%), then fodder crops (119%).

However, the variations recorded between the farms surveyed are relatively small with regard to the number of bovine heads in general (21%) and the number of dairy cows (35%).

As for the statistical indicator “coefficient of variation”, it allowed us to focus firstly on the disparities between the farms surveyed, in fact, the greatest variations concerned the choices of crops practiced such as cereals, fruit trees and other herbaceous crops. This disparity has also been observed on farms in the semi-arid region of western Algeria, with consequent technical and structural constraints (Yerou *et al.*, 2019). The variation for fodder crops among farms was explained by the reduced number of farmers who practiced these crops, *i.e.* 47.36 with fodder areas less than or equal to 0 and the few farmers who devoted between 10 and 20 hectares for fodder, or 15% of the total surveyed.

CONCLUSION

In conclusion, the study revealed that the areas allocated to fodder are below what they should be in order to meet the needs of a dairy cattle herd that is experiencing a positive development in terms of numbers. In addition, the proportions by quantiles found allowed us to conclude that two thirds of the dairy farmers surveyed practice fodder crops on very small areas. Explicitly, we recorded very low forage areas, not exceeding 20 hectares at the level of the farms analyzed. This worrying situation should call for more prospecting and studies to discern the multiple and proven causes that would explain these fodder deficits, given that perfect knowledge of the farming conditions, for which feeding is a necessary prerequisite, for any action aimed at to improve milk production.

Consequently, it becomes essential to find practical solutions to help breeders to opt for better choices concerning the feeding of their dairy cattle and thus to contribute in the development of the dairy production in the province of Blida, especially as regards of Mitidja known for its fertile land, 50% of which is irrigated. Therefore, the possibilities of developing; it is enough to put a plan aiming at improving the existing potentialities by the improvement of the technical itinerary and the increase in the yields of the existing crops, the extension of the fodder surfaces, the introduction of new crops and the improvement of the pastures. As recommended Benidir *et al.* (2020) for the semi-arid context, the conversion of the cropping system from cereal-fallow to the cereal-forages system.

Conflict of interest

There is no conflict of interest for this manuscript.

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