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# Feeding Practices of Dairy Owners in Semi-arid Region of Algeria

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## ABSTRACT

**Background:** This work aims to analyze and evaluate the feeding systems of dairy farms in order to provide a diagnosis of the constraints and potentialities of current food practices under Algerian production conditions, particularly in the semi-arid region of Sétif.

**Methods:** The survey was carried out between 2021-2022 on 147 farms in the different agro-ecological zones of the semi-arid region of Sétif. The data were collected through personal interviews using the structured schedule. A survey was conducted to acquire information on farm structure and feeding practices.

**Result:** Depending on the practice of grazing, two types of farms have been established: the zero-grazing system in 7.48% of farms, based on dry fodder supplemented by a large quantity of concentrated feed at 15 kg/cow/day on average, while the semi-grazing system was used in 91.40% of farms with an average of 10.2 kg/cow/day of concentrated feed distributed. The study of the current situation of dairy cow feeding systems shows that pasture, cereal straw, commercial concentrate and wheat bran were the most used feeds in the semi-arid region of Sétif. This finding requires the adoption of an adequate and precise rationing strategy to ensure good profitability of dairy farming.


**Key words:** Dairy cows, Farms, Feeding, Management practices.

## INTRODUCTION

In Algeria, the food policy has paid particular attention to milk, as a major animal protein sources, with an average consumption of 150 liters of milk/capita/year (FAO, 2015), compared to the 90 l/capita/year set as the international standard by the World Health Organization. Dairy cattle herds play an important role in the agricultural economy and provides the majority of local milk production, which remains insufficient in relation to the massive and growing demand of the population and covers on average only 56% of the usual needs (Chemma, 2017).

The measures taken by the government between 2009 and 2015, within the framework of several development plans to improve milk sector, led to a positive growth in milk production; nevertheless, it remains low compared to the genetic potential of modern dairy cattle, which averages around 3600 kg/cow/lactation in Algeria, compared to 5000 to 6000 kilograms per lactation in its country of origin (Abbas, 2014; Bellil and Boukrif, 2021).

Numerous socio-economic, agricultural and health factors contribute to the low productivity of dairy farms (Zalani *et al*., 2021). The most limiting factor in the productivity of dairy cows is feed, which represents 70% of the cost of milk production and the most important part of the operational costs of animal production (Kadi, 2007; Djermoune *et al*., 2018).

Feeding farm animals is a multidimensional and recurrent problem for farmers who must respond to several concerns at the same time, namely meeting the nutritional needs of animal maintenance and production, ensuring product quality, optimizing feed costs and avoiding waste and pollution (Zirmi-Zembri and Kadi, 2016). Feeding systems suffer from a chronic deficit, unbalanced rations and poor quality of staple feed. Moreover, the use of off-farm resources can significantly hamper the economic profitability of dairy business.

This work aims to analyze and evaluate the feeding systems of dairy farms in order to detect possible errors that contribute to a decrease in milk production of cows. It is intended to provide a diagnosis of the constraints and potentialities of current food practices under Algerian production conditions, particularly in the semi-arid region of Sétif.

## MATERIALS AND METHODS

The province of Sétif is located at an altitude of 1100 meters in the high plains of eastern Algeria. It is one of the coldest regions of the country during winter and is characterized by

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a continental semi-arid climate with three bioclimatic stages. The average annual rainfall on the entire province territory is 400 mm.

The survey was carried out between 2021-2022 on 147 farms in the different agro-ecological zones of the semi-arid region of the province of Sétif. These farms made a total of 1726 dairy cows of different breeds. The data were collected through personal interviews using the structured schedule. The questionnaire used to obtain these results covered two parts: The first related to the structural characteristics of the farm (the number of cattle, the composition of the herds, the agricultural area, the vegetable crops and the water resources), while the second allocate factors related to dairy cow feeding, such as forage types and diet compositional aspects as well as feed supplementation practices and the amount of daily feed rations provided to cows throughout the year. Indeed, no study was conducted in terms of the composition of feed rations used in dairy cattle herds to determine the seasonal specificity used at farm level.

All survey data collected was coded and processed with Excel computer software. The data in concern was the subject of descriptive statistics for each of the parameters (means, standard deviations and proportions) and ANOVA with post-hoc Tukey HSD Test using the software (SPSS version 27.0).

## RESULTS AND DISCUSSION

### Structural characteristics of farms in the study area

The results in Table 1 showed that 3.40% of respondents are under 25 years old, while 76.87% are between 26 and 49 years old and farmers aged 50 and over represent 19.73%. According to the number of workers, results showed farms had one, two and more than three workers at a rate of 48.98%, 25.17% and 25.85% respectively.

The majority of surveyed farmers (80.26%) had a moderate level of education, while 12.24% were uneducated and 7.48% were university graduates. Moreover, most farmers (87.07%) had no agricultural training. These results are close to those in the wilaya of Tizi Ouzou, where Kadi (2007) pointed out that most of the respondents had a moderate level of education, while 10% are without and 8.75% are university graduates; however, 97.50% of farmers do not receive any agricultural training.

The results revealed that 75.51% of the farmers were engaged in full-time dairy farming activity, while 24.49% had different non-agricultural economic activities and took dairy farming as a secondary activity to supplement their income. According to the type of production, 34.01% of farmers were specializing in dairy production. While the remaining 65.99% adopted a mixed milk-meat animal farming system. These findings comply with Semara *et al.* (2018) which revealed a drop in the proportion of farms specializing in dairy production in the region of Sétif, where they switched to mixed systems due to the low economic profitability of milk as the main product, especially after the inflation in the price of concentrated feed.

### Land specification and animals per farm

The number of workers varies according to the size of the farm (1 to 48 workers), with 2.37 Human Worker Units on average. The rented surface was from 0 to 150 ha with an average of 7.43 ha (Table 2). The number of dairy cows in the surveyed farms was from 1 to 300 heads, with an average of 7.16 heads per farm. The majority of farms (70.74%) have

**Table 1:** General characteristics of the surveyed farms in the study area.

| Categories/characteristics | | Frequency | Per cent % |
|---|---|---|---|
| Age groups | ≤25 | 5 | 3.40 |
| | From 26 to 49 | 113 | 76.87 |
| | ≥50 | 29 | 19.73 |
| Number of workers | 1 | 72 | 48.98 |
| | 2 | 37 | 25.17 |
| | More than 3 | 38 | 25.85 |
| Education level | None | 18 | 12.24 |
| | Primary | 50 | 34.01 |
| | Medium | 20 | 13.60 |
| | Secondary | 48 | 32.65 |
| | Academic | 11 | 7.48 |
| Agricultural training | Yes | 19 | 12.93 |
| | No | 128 | 87.07 |
| Nature of the activity | Principal | 111 | 75.51 |
| | Secondary | 36 | 24.49 |
| Production system | Dairy | 50 | 34.01 |
| | Mixed | 97 | 65.99 |
| Agricultural land existence | Yes | 131 | 89.12 |
| | No | 16 | 10.88 |

less than 10 cows. For 27.21% of farms, the number is between 11 and 50 heads, while the remaining 2.05% of farms have more than 50 dairy cows. According to Métref (2004), the distribution of cattle farms in Algeria by size shows that 93.3% of farms have less than 10 cows, while farms with a number of more than 50 cows do not exceed 0.3%. The cultivable farming areas surveyed are very variable, ranging from 0.5 to 280 ha of utilized agricultural area (UAA) with a total of 2564.5 hectares and an average of 19.58 hectares, where 14.87% of this is intended for fodder cultivation (from 0 to 30 hectares, with an average of 2.92 ha); this proportion is very low compared to the UAA.

However, 63.90% of farms have no forage areas. In the province of Ghardaïa, Ouarfli and Chehma. (2018) find that 71.1% of farms have a forage area of 0 to 1 hectare. The same situation is encountered in the province of Souk-Ahras by Yozmane *et al.* (2019) and the province of Adrar by Boubekeur and Benyoucef (2014), where they showed that the land involved in fodder production in all the farms studied only shows 22.24%, 15.8% respectively of the UAA.

## Feed resources

In the majority of surveyed farms, animal feed varied according to the seasons, influencing the availability of fodder resources. The most important feed resources used by dairy owners are cereal straw, commercial concentrate, pasture and wheat bran (Table 3). Likewise, Mouhous *et al.* (2014), Djermoun *et al.* (2018), had demonstrated that the diet of dairy cattle in Algeria is characterized by the excessive use of dry hay and concentrates.

Whatever the season, the majority of farms use cereal straw as the main staple feed throughout the year. In addition, 34% of the farmers add corn silage to the basic ration during winter which decreases to 9.53% during the other seasons because of the use of grazing which ensures the supply of green fodder. The same situation was observed among the 25.90% of farms that used oat hay in winter versus 5.66% of farms in other seasons, also 23.80% of farms feed alfalfa to their animals during the winter, against 8.40% of farms in other seasons.

Wheat bran was the most used agro-industrial by-product because of its great accessibility and its relatively low cost, subsidized by the government to encourage farmers. It was used by 46.60% of farms as a complementary feed when good quality fodder is present. Likewise, Kadi (2007) revealed that 52.5% of farmers used wheat bran as a complementary feed.

While this dependence decreases during winter when 90.5% of farms relied on the use of commercial concentrate with distributed quantities on average of 11.9 kg/cow/day in

**Table 2:** Farms lands specifications in the study region.

| Farms lands | Total | Minimum | Maximum | Average | SD |
|---|---|---|---|---|---|
| TAA (ha) | 4871 | 2 | 1450 | 37.18 | 131.37 |
| UAA (ha) | 2564.5 | 0.5 | 280 | 19.58 | 33.48 |
| FA (ha) | 383 | 0 | 30 | 2.92 | 5.36 |
| LA (ha) | 973 | 0 | 150 | 7.43 | 19.25 |
| HWU | 349 | 1 | 48 | 2.37 | 4.21 |
| Number of dairy cows | 1726 | 1 | 300 | 7.16 | 21.17 |

UAA: Useful agricultural area, TAA: Total agricultural area, FA: Forage area, LA: Leased area, HWU: Human worker unit.

**Table 3:** Feeds in different seasons in the study area.

| Feed/season | Winter | Spring | Summer | Autumn |
|---|---|---|---|---|
| Ryegrass Hay, % | $25.90_{a}$ | $6.10_{b}$ | $6.10_{b}$ | $4.80_{b}$ |
| Pasture, % | $7.50_{a}$ | $92.50_{b}$ | $91.20_{b}$ | $90.50_{b}$ |
| Wheat straw, % | $97.30_{a}$ | $69.40_{a}$ | $70.10_{a}$ | $74.80_{a}$ |
| Corn silage, % | $34.00_{a}$ | $8.20_{b}$ | $10.20_{b}$ | $10.20_{b}$ |
| Wheat bran, % | $40.10_{a}$ | $49.70_{a}$ | $48.30_{a}$ | $48.30_{a}$ |
| Field peas, % | $9.50_{a}$ | $6.80_{a}$ | $6.80_{a}$ | $6.80_{a}$ |
| Oats, % | $21.80_{a}$ | $12.90_{a}$ | $13.60_{a}$ | $13.60_{a}$ |
| Commercial concentrates, % | $90.50_{a}$ | $72.10_{a}$ | $74.10_{a}$ | $74.10_{a}$ |
| Corn, % | $2.70_{a}$ | $1.40_{a}$ | $1.40_{a}$ | $1.40_{a}$ |
| Alfalfa, % | $23.80_{a}$ | $7.50_{b}$ | $8.20_{a,b}$ | $9.50_{a,b}$ |
| Vetch-oats, % | $1.40_{a}$ | $0.00_{a}$ | $0.00_{a}$ | $0.00_{a}$ |
| Barley, % | $6.10_{a}$ | $0.00_{a}$ | $0.00_{a}$ | $0.00_{a}$ |
| Waste bread, % | $1.40_{a}$ | $1.40_{a}$ | $1.40_{a}$ | $1.40_{a}$ |
| Mash, % | $6.80_{a}$ | $5.40_{a}$ | $5.40_{a}$ | $5.40_{a}$ |

Each subscript letter denotes a subset of season categories whose column proportions do not differ significantly from each other at the 0.05 level.

winter, compared to 9.6 kg/cow/day during the other seasons; however, the quantity used all year round was 10.2 kg of concentrated feed/cow/day. These quantities are close to those reported by Si-Tayeb *et al.* (2015) in Tizi-Ouzou province, where he noted that the cows received an average of 9±3 kg of concentrated feed/day and dry cows and heifers received less concentrate at 4.2 kg and 5.9 kg/cow/day respectively.

Commercial concentrates were ranked the second most important feed resource and used year-round to supplement dairy cows. Wheat bran, maize, soybean meal and the mineral-vitamin supplement are the main ingredients of the commercial concentrate mixture which is adopted by 88.43% of farmers. However, 11.64% of farms preferred to prepare the mixture of concentrates in situ. Correspondingly, Yozmane *et al.* (2019) said that portions of concentrate were significant in the ration of dairy cows with a daily average of 7.42±2.45 kg per cow which contain wheat or barley bran, soybean meal and maize. These concentrated feeds which are generally provided by the feed mills has content of 18% crude protein.

In what concerns the form of concentrate, three types were identified: flour, granules and mash (contains a source of fiber) which are used respectively in 66.66%, 28.57% and 4.08% of farms. It was observed that 1.40% of farms surveyed in the study area are not limited to the use of conventional feed resources. These farms are characterized by their small size which cannot afford to buy industrial by-products and commercial concentrates due to financial constraints. This situation was also reported by Bâa (2008) in dairy farms of Biskra region and by Boubekeur and Benyoucef (2014) in Adrar region where he declared that the surveyed farmers use another source of feed, which constitutes by the valorization of the waste of dates and crop residues.

The distribution of barley was limited to 6.10% of farms during the winter period. Table analysis shows that forage pea was present in 7.47% of exploitation. This use predominates in the northern region of the study area. Mineral supplementation was present in 49.65% of farms, of which 32.65% of farms use mineral block, while 9.52% of farmers provide salt to their animals as a mineral supplement. This is in agreement with Kadi *et al.* (2008) who reported the mineral block is used in 32.5% of farms.

The result of the study revealed that about 26.53% of farmers have changed the feed abruptly without taking into consideration the time required for the cows to adapt with the new diet.

**Feeding systems**

In the present study, we can distinguish two types of farms depending on the grazing practice: the zero grazing system where the animals are bred and fed in the barn and the semi-grazing system where the animals are kept in stalls during the winter and the feed ration is based on cereal straw, hay and concentrate. During the other seasons, feed is provided by fodder resources from pasture, as well as supplementation based on concentrates (Pugliese *et al.,* 2021).

However, 7.48% farm practice dairy farming in soilless system because of the absence of land or have insufficient forage areas from 0 to 3 ha. In circumstances like these, most animals' feeds are acquired from outside the farm, where herd's feed throughout the year is based on dry fodder supplemented by a large quantity of concentrated feed. In these farms, an average of 15 kg/cow/day of concentrates was observed, besides an individual supplementation of 2 to 5 kg, depending on the level of production of dairy cows, in order to increase their profit from milk production. Furthermore, Notz (2019) demonstrated that the excessive use of concentrate by farmers as a criterion for increasing milk production induces a deterioration in the health of cows with an increase in hoof diseases and disorders in milk production and cow's fertility.

This is a type found in the west of the country without a land base for crop as reported by Bousbia *et al*. (2016) and even in several regions of Morocco where the soilless type is characterized by a high use of concentrate (Srairi, 2007). Moreover, (Belkheir *et al.,* 2015; Mouhous *et al.,* 2014) revealed that this situation can have adverse effects on the sustainability of the milk sector in the region and constitutes a constraint to the development of these farms.

During the grass season, it has been observed that in 91.40% of farms, feeding dairy cows was based on grazing which ensures the supply of natural fodder consisting of rangelands, natural meadows and fallow land, with an average of 6 to 10 grazing hours daily. Cereal stubble was exploited during the dry season. Nevertheless, grazing generally does not cover the needs of the animal, which makes the addition of concentrated complementary feed and fodder mandatory where the quantity of fodder as-Fed distributed to dairy cows varies from 8.1 kg/cow/day in grazing seasons to 14.3 kg/cow/day in winter. This is in agreement with Tedjari *et al.* (2014) in the semi-arid region of Sétif which affirmed that the modalities of use of pastures are according to the seasons and the fodder supply.

According to Zirmi-Zembri and Kadi (2016) Grazing consists of multiple forage species which is characterized nutritionally by a wide variability in nutrient values ranging from 0.31 to 0.99 UFL/kg DM for Net energy for lactation value and from 4.39 to 180 g/kg DM for digestible dietary protein value.

**Livestock watering**

The water needs of dairy cows depend on the composition of the ration and the level of milk production and the outside temperature. In temperate climates, lactating cows are very sensitive to quantitative water deprivation, restricting the amount of water available to cows to 25% of the amount of water drunk ad libitum can reduce milk production to 10% in a few days (INRA, 2018).

In this study, the results revealed that dairy cows have free access to water in 68.02% of farms; whereas, 31.97%

of the farms, dairy cows had limited access and water was distributed once a day in winter and twice a day in other seasons. Benatallah *et al.* (2015) showed that the water supply was insufficient in almost all the farms surveyed where the "Long absence of thirst" scores are the lowest. Bourdon *et al.* (2013) recommended making sure that the herds always have the quantity and quality of water needed because a slight under-watering causes an immediate decrease in food consumption and milk production.

### Watering sources

Several water sources were used by surveyed farms. Indeed, 58.50% of farmers favored the use of mains water for watering their animals. Drilling water came in the second place with 32.65% of farms, then came wells and the streams which were present in 24.48%, 4.76% of farms, respectively. Only 0.68% of farms used the dam to supply their animals with water.

## CONCLUSION

The study of the current situation of dairy cow feeding systems shows that pasture, cereal straw, commercial concentrate and wheat bran were the most used feeds in the semi-arid region of Sétif. The scarcity of fodder resources, especially in the dry season, has been identified as the most important constraint to the development of cattle breeding and dairy production in the region. Excessive use of imported concentrated feed is still the only way to produce milk. In addition, with the increase in animal feed costs, the cost of production does not guarantee comfortable, or even non-existent, profit margins for the dairy business.

It is evident that feed management on dairy farms was not based on scientific knowledge, which contributed to relatively poor cow performance as well as significant financial losses. This finding requires the adoption of an adequate and precise rationing strategy to ensure good profitability of dairy farming. Technical support must be provided to dairy farmers to direct them towards better control of fodder systems such as modern techniques of conservation and diversification of fodder and to update their knowledge on the feeding of dairy herds for a good use of resources available.

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### Conflict of interest

All authors declare that they have no conflicts of interest.

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