Agri-Environmental impact on main productivity traits of the Valdostana breed raised in Transylvanian area

Received for publication, June 8, 2015
Accepted, December 20, 2015

GRIGORE ONACIU¹, LIVIA VIDU², EUGEN JURCO*¹
¹University of Agricultural Sciences and Veterinary Medicine, Faculty of Animal Science and Biotehnologies, 3-5 Manastur Avenue, Cluj Napoca, Romania
²University of Agronomical Sciences and Veterinary Medicine Bucharest, Faculty of Animal Science, 59 Măraști, Avenue, Bucharest, Romania
*Address correspondence to: University of Agricultural Sciences and Veterinary Medicine, Faculty of Animal Science and Biotehnologies, 3-5 Manastur Avenue, Cluj Napoca, Romania. Tel.: +40264596384; *Corresponding adress: Email: jurco_eugen@yahoo.com

Abstract
The purpose of this research was to investigate the agri-environmental impact on main productivity traits of the three strains of Valdostana breed. The growth and body development was appreciated on the weight and body measurements at different stages of age: at 2 weeks, 3 months, 6 months, 12 months, 16 months and 18 months. During the whole period it was established that they have a body weight at two weeks about 35.71 kg, 74.2 cm waist, and at 18 months 370 kg, waist 114.7 cm, with average daily gain between 0.580 kg to 0.664 kg. The precocity was analyzed according to age at first mattings and first calving, which had averages of 526 days, respectively, 810 days. Data on individual milk yield and quality were obtained through the analysis of individual morning samples collected in the three phases: at 50 days of lactation, 100 days of lactation and 150 days and the milk yield and qualitative parameters in 1st lactation was average of 8.7 kg/day, fat content 4.04% and 3.33% protein, pH 6.57, milk urea (MU) 26.21 mg/dl with milk urea nitrogen (MUN) 12.3 mgN/dl. Number of somatic cell showed a low levels during all three control days, being averaged by 165.5 somatic cells/ml x 10³.

Keywords: Valdostana breed, morphologic traits, milk yield, qualitative traits, Transylvania area

1. Introduction
Animal breeding and especially dairy and beef livestock has been and can be a leading sector for agricultural economy in Transylvania area. Within an area with herds depopulated, import and accommodating new breeds of cattle is a solution for area developing the conditions of sustainable agriculture. However, in the last 25 years and especially after EU integration for Romania in 2007, the number of cattle were reduced by 3 million heads (56.6%) with a load of only 16.1 head/ 100 ha agricultural land (arable, pastures and meadows), it was confronted by dramatic reduction in farm number, failure increase in the number on animals per farm without reducing the herds, raise in indoor production systems and growth non-indigenous cattle breeds from imports.

In comparison to many Western European countries, in Romania (especially Transylvania area) the use of common pastures remains widespread and is strongly linked to
Agri-Environmental impact on main productivity traits of the Valdostana breed raised in Transylvanian area

the predominance of subsistence and semi-subsistence farming in much of the country. The majority of permanent pasture in the country is under state or community ownership, and these areas are of high natural and cultural, as well as economic importance for Romania, (LAURA SUTCLIFFE & al., [12]). In this Romanian agricultural context and farmer preference for Valdostana breed arrived this biological material from the Italian Alps, having pronounced regional characteristics, was transferred in very different agricultural and technological raising conditions from Transylvania.

Breeding conditions of Valdostana breed cattle in the mountainous region from the Italian Alps, respectively Valle d’Aosta region (with possibilities for alpine grazing, in June-July at medium height pasture (1500÷2000 m a.s.l.), and in July-August, at high pasture (>2000 m a.s.l.) shows significant differences compared to agricultural conditions (arable land, pastures, meadows) from the village Jucu and Sava (with an average altitude of 320 m a.s.l.), Cluj county from Transylvania area, Romania. This particular situation was the main reason why we decided to analyze the capacity of accommodating and main productivity traits in the new conditions associated with morphological traits and the production of milk in the first lactation.

The Aosta Valley is an Alpine valley which with its tributary valleys includes the Italian slopes of Mont Blanc, Monte Rosa and the Matterhorn. The Valdostana is an indigenous dual purpose Italian breed mainly raised in Valle d’Aosta region (with a total effective of 40,227 heads registered) and has three strains which differ in morphology characteristics, coat colour, production and temperament: Valdostana Pezzata Rossa (VPR), the Valdostana Pezzata Nera (VPN) and Castana (CB).

Valdostana Pezzata Rossa, is very adapted to harsh climates and resistant to many pathogens, docile and strong, has a robust constitution and a conformation corresponding to mixed type of production (milk-meat), while the Pezzata Nera and Castana, predominantly for meat production, is massive, with a harmonious exterior appearance, which are distinguished by the breadth and depth pronounced [15]. This strains is lively and quite aggressive and it is also selected for fighting ability (SARTORI and MANTOVANI, [11], [12]).

Valdostana breed, is characterized by a medium sized, with a weight of 600-650 kg for males and 450-550 kg for females [15] and milk production between 3,417 and 4,264 kg depending on lactation, for the VPR and from 2,387 to 3,358 kg for the VPN and CB respectively [16].

Alpine breeding systems are an example of sustainable integration between land management and productive processes the inherent forage exploitation has characterized and modified landscape and environment. Moreover, alpine pasture has increased its importance for the multifunctional features attributed in the recent years to mountain productive activities (AGABRIEL & al., 2001) quoted by L. Battaglini & al., 2005.

A fundamental role for the growth and development of this sustainable form of mountain farming must be played by the public subsidy which should be determined according to the real environmental service given. In the present economy, this form of financial support is a mandatory keystone on which a low producing environmental friendly dairy system must be built. Further support to the profits of the extensive farmers might come from the labeling of specific dairy products with geographical indications and designations of origin (PDO, PGI marks) as well as from the farm conversion into the organic system of production. (GIULIO COZZI & al., [5]).
2. Materials and methods

Aim of this work was to test growth and development of young cattle, puberty period until the first fecund insemination, first calving and milk production in the first lactation. It has been also analyzed some morphological traits and the yield and quality of cow’s milk produced in agricultural conditions of Transylvania region by the three strains of the Valdostana breed.

The study was conducted during the period from February 2012 to September 2014, observing the growth rate and body development, body condition, precocity, productivity and health condition of 25 calves from the three strains of the Valdostana breed: 10 heads Valdostana Pezzata Rossa (VPR), 8 heads Valdostana Pezzata Nera (VPN) and 7 Castana (CB). This effective was imported in Romania in February 2012 at a very young age, immediately after birth the age of 2 weeks and raised in two farms, Jucu and Sava village from Cluj county, Transylvania area.

The weight and body measurements refer to: height at withers, height at croup, length of the trunk, chest width, chest depth, chest circumference, croup width were determined at different stages of age: at 2 weeks, 3 months, 6 months, 12 months, 16 months and 18 months.

Data on individual milk yield and quality in 1st lactation were obtained through the analysis of milk collected from the whole udder of 20 cows during the morning milking in the three phases: at 50 days of lactation, 100 days of lactation and 150 days. A total number of 60 raw milk samples were collected in clean and sterile sample bottles and was brought to the Laboratory of Milk’s Quality Control Foundation from Florești, Cluj County, for the analysis of pH and fat, total protein, casein, lactose, urea, and somatic cell content.

Processing and interpretation of data obtained was done at the group level, calculating through statistical methods the average and its elements for each character separately.

The housing of the animals was carried out in stable with loose housing in the cold season and pasture in the warm season. The data were statistically processed and were interpreted in accordance with the specialized literature.

3. Results and discussion

Globally, livestock production is different from country to country depending on the development of the animal husbandry sector and the productive potential of existing breeds. Breeds and populations existing at the moment within each species, bear the imprint of environmental conditions and also of human directional activity and the benefits of each species must be interpreted in the light of technical and economic efficiency in relation with the biological adaptability to different growing and exploitation conditions, (SANDU MARIANA & al. [13]).

Analyzing the growth process of the young female until age of first insemination, it was established that they have a body weight at two weeks about 35.71 kg, 74.2 cm waist, at 12 months of 241.98 kg, waist 103 cm and at 18 months 370 kg, waist 114.7 cm, average daily gain in the first year of life was 593 g/day, and for heifers 18 months of age, 623 g. Close results were obtained by the F. ABENI & al. in 2003, for Valdostana breed (VPR) raised in the area of origin, were for all heifers witch have calved in autumn 1998, respectively: 356, 357 and 403 kg of body weight (BW) at calving; 27.6, 29.2 and 32.0 kg of calf birth weight.

Taking into consideration the entire period for all three strains, Table 1 presents the live weight and body measurements. During the researches period (548 days) average daily gain was between 0.580 kg to 0.664 kg, growth coefficient calculated for body weight at the age of
Figure 1. Evolution of the main indicators of body growth Romanian Biotechnological Letters, Vol. 20, No. 3, 2016

18 months in relation to the adult weight, reveals value of 67%. Also, growth coefficient was calculated for three strains of Valdostana cattle which differ as body weight at the age of 18 months in relation to the adult weight, reveals value of 63% for VPR, 65% for VPN and 71% for CB, (ONACIU G. & al. 2013[7]).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>M.U.</th>
<th>2 weeks</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
<th>16 months</th>
<th>18 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW kg</td>
<td></td>
<td>35.7±0.35</td>
<td>76.65±1.32</td>
<td>129.12±1.66</td>
<td>241.98±2.65</td>
<td>327.78±2.80</td>
<td>370.08±2.75</td>
</tr>
<tr>
<td>HW cm</td>
<td></td>
<td>74±1.03</td>
<td>83.5±1.12</td>
<td>93.5±1.80</td>
<td>103±1.75</td>
<td>108±1.78</td>
<td>114.7±1.48</td>
</tr>
<tr>
<td>HCr cm</td>
<td></td>
<td>76±1.05</td>
<td>85.5±1.08</td>
<td>96±1.66</td>
<td>104±1.88</td>
<td>112±1.72</td>
<td>116.2±1.15</td>
</tr>
<tr>
<td>DLT cm</td>
<td></td>
<td>67.8±0.97</td>
<td>87±1.35</td>
<td>101±2.10</td>
<td>112±1.80</td>
<td>125±2.20</td>
<td>127.3±1.24</td>
</tr>
<tr>
<td>ChW cm</td>
<td></td>
<td>15.3±0.88</td>
<td>20±1.11</td>
<td>24±1.50</td>
<td>27±1.70</td>
<td>32±1.40</td>
<td>34.8±1.85</td>
</tr>
<tr>
<td>CrW cm</td>
<td></td>
<td>15.7±0.92</td>
<td>21.5±1.16</td>
<td>24.8±1.62</td>
<td>29±1.65</td>
<td>36±1.54</td>
<td>38.5±1.75</td>
</tr>
<tr>
<td>ChC cm</td>
<td></td>
<td>77.3±0.7</td>
<td>109.5±1.80</td>
<td>126±1.64</td>
<td>147±2.10</td>
<td>156±2.40</td>
<td>161±1.57</td>
</tr>
<tr>
<td>DCh cm</td>
<td></td>
<td>30.5±0.70</td>
<td>38±1.45</td>
<td>44.5±1.78</td>
<td>50.5±2.49</td>
<td>53±1.82</td>
<td>54.5±1.25</td>
</tr>
</tbody>
</table>

BW- Body weight, HW- Height at Withers, HCr- Height at Croup, DLT- Diagonal length of the trunk, ChW- Chest Width, CrW- Croup Width, ChC- Chest Circumference, DCh- Depth of chest

Morphological evaluation is one of the selection tools used in many cattle breeds, as well as in the Valdostana cattle. Conformation traits have been recorded for years in many other breeds, for example in Holstein- Friesian (MEYER & al., 1987; BERRY & al., 2004), Brown Swiss (VUKASINOVIC & al., 1997; WIGGANS & al., 2006), and in some Italian indigenous cattle breeds, such as Piemontese (Mantovani et al., 2010), Chianina, Marchigiana and Romagnola (FORABOSCO & al., 2005) and Rendena (MANTOVANI & al., 1997).
The second part of this study was regarding the determination of milk composition during various stages of 1st lactation and the results are presented in Table 2.

The results show a high milk yield and good amounts of milk fat and protein compared with the yields obtained to Valdostana breed, raised in the area of origin. The mean production of all three groups of cows during the observation period was 10.38±2.21 kg, 8.21±2.02 kg and 7.51±1.49 kg for the each intervals of collection. This breeds showed an overall a fat percentage of 4.04±0.30%, protein percentage of 3.33±0.23% and 4.47±0.19% lactose percentage.

<table>
<thead>
<tr>
<th>Specification</th>
<th>M.U.</th>
<th>50 days of lactation (n=20)</th>
<th>100 days of lactation (n=20)</th>
<th>150 days of lactation (n=20)</th>
<th>Average (n=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Milk yield</td>
<td>kg</td>
<td>10.38</td>
<td>2.21</td>
<td>8.21</td>
<td>2.02</td>
</tr>
<tr>
<td>Fat</td>
<td>%</td>
<td>3.83</td>
<td>0.27</td>
<td>4.09</td>
<td>0.25</td>
</tr>
<tr>
<td>Protein</td>
<td>%</td>
<td>3.21</td>
<td>0.21</td>
<td>3.36</td>
<td>0.23</td>
</tr>
<tr>
<td>Casein</td>
<td>%</td>
<td>2.60</td>
<td>0.19</td>
<td>2.71</td>
<td>0.20</td>
</tr>
<tr>
<td>Lactose</td>
<td>%</td>
<td>4.58</td>
<td>0.18</td>
<td>4.47</td>
<td>0.16</td>
</tr>
<tr>
<td>Urea</td>
<td>mg/dl</td>
<td>18.60</td>
<td>12.18</td>
<td>30.81</td>
<td>11.38</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>6.58</td>
<td>0.06</td>
<td>6.55</td>
<td>0.11</td>
</tr>
<tr>
<td>Somatic cell</td>
<td>no/ml x10^3</td>
<td>107.85</td>
<td>81.64</td>
<td>215.45</td>
<td>89.11</td>
</tr>
</tbody>
</table>

It is important to note that all three groups taken into account were reared in the same farm, fed with the same fodder and so differences of fat, protein and lactose content showed among strains breeds.

Evaluation of milk production by normal lactation (305 days) was determined by controlling diversified, based on three controls (C1-C3) resulting a production of 2457 liters of milk with 4.03% fat and 3.33% protein (figure 2).

![Figure 2. Yield and milk quality traits estimated by random evaluation](image-url)
Thus, following research conducted by F. Abeni et al in 2003 on a herd of thirty-eight heads, milk production was between 2433 and 3037 kg for 305-days of lactation. In what concern fat and protein production they were between 85.6 and 103.1 kg, respectively 81.6 and 98.9 kg.

Similar research in the country of origin shows data on individual milk yield and quality were relevant to the three main phases of pasture: the first, in June-July, at medium height pasture (1500÷2000 m a.s.l.), the second, in July-August, at high pasture (>2000 m. a.s.l.) and results depend causes of variation in yield and quality of cow’s milk produced in pasture conditions in different alpine sites of Aosta valley (N-W Italy) by the three dairy autochthonous breeds, the Aosta Red Pied, the Aosta Black Pied and the Aosta Chestnut. (L. BATTAGLINI & al. 2005, [2]). In Aosta valley autochthonous cattle breeds have a particularly high adaptation degree to alpine environment and this feature makes them tightly bound to their territory (BIANCHI & al., 2003); there, milk represents the main livestock productive objective for the particular interest linked to its almost total transformation into Fontina PDO cheese (PROLA, 2001). In Aosta region in the last years particular attention has been dedicated to milk fatty acids composition and CLA content and the relevant correlations with diets based on grass (CHILLIARD & al., 2002): in fact, it is well known that milk products originating from high alpine grazing of cows seem to provide an extraordinarily high proportion of 9c11t-conjugated linoleic acid (CLA) and omega-3 (n-3) polysaturated fatty acids (KRAFT & al., 2003; LEIBER, 2004) allowing these products to be considered as functional foods with an expected high value for human health (HAUSWIRTH & al., 2004), all quoted by L. Battaglini & al., 2005.

Another important characteristic taken into account was the number of somatic cell, which showed a low level during all three control days, being averaged by 165.5 somatic cells/ml x10^3, which shows a good mammary gland health, have not been identified cases of sub clinical mastitis, clinical or mastitis.

Mastitis is a costly health problem in dairy cattle (HILLERON and BERRY, 2005) generally caused by bacteria infection of the udder that results in an increase of somatic cell count (SCC) in milk. In dairy cattle therefore SCC has been used as an indirect trait for genetic improvement of mastitis resistance for the large genetic correlation between SCC and direct mastitis and for the possibility of data collection of SCC during routine milk recording (Shook and Schutz, 1994). Even if high SCC in milk is indicative of both clinical and sub clinical mastitis, the increase and the pattern of SCC in milk during a mastitis episode depends on several environmental factors (MRODE and SWANSON, 1996) and on the pathogens causing the infection (DE HAAS & al., 2002) all quoted by A.B. Samore & al., 2008.

Reproductive function analysis showed a very good health, calving ease, maternal instinct pronounced and absence postpartum diseases, but should be specified that Valdostana breed (VRP) is more sensitive in reproductive disease occurrence, risk associated with high production of milk. Results show that risk of metritis is higher in herds with milk yield between 3,000 and 4,000 kg. Furthermore, in Valdostana Red Pied, characterized by a higher milk yield compared to Valdostana Black Pied and Castana, the risk of anoestrus, persistent corpus luteum and acyclic ovaries is higher, (RIZZI, R. & al., 2003[9]).

4. Conclusions
The success of a breed of cattle relocation into new raising areas depends largely on its ability to accommodate, milk and meat production performance, reliability and economic value
of race, issues of interest to the Romanian farmer. The same time cattle breeding sector from Romania in this moment have two of the difficult problems facing both animal husbandry and farmers at this moment is the recovery of the cattle and buffaloes to the 50 heads / 100 ha of APM (arable pastures and meadows), which we consider as minimum value compared to the reference Romanian agricultural potential and and another major problem is the number of active farmers in cattle breeding is decreasing without balancing in increasing farm size.

The original element of our research on accommodating a Valdostana breed is that the biological material has been transferred to the new raising conditions at 2 weeks, immediately after birth. This has allowed the evaluation in animal growth and development through the first lactation of genetically consolidated attributes along generations, in conditions of altitude, such as: rusticity and resistance to raising conditions, morphological and physiological characters and milk and meat productivity. Our researches results about accommodation Valdostana breed show a good development of the breed in the new conditions from Cluj county, Transyilvania area, with the real possibility of increasing herds and production in both directions in conditions of sustainable agriculture.

The presented data shows that body development and productivity of the 25 heads Valdostana breeds in new conditions of breeding with growth coefficient calculated for body weight at the age of 18 months in relation to the adult weight, reveals value of 67%. It was also recorded good average daily gain, reported to rustic raising conditions, which was between 0.580 kg to 0.664 kg. In the grazing season, young females presented compensatory growth by a very good utilization of grass, in conclusion, young females and heifers from Valdostana breed shows good pretability for grazing extended up to 200 days per year, with implications for the economy of production.

Age at first insemination respectively first calving for the all three strains of the breed Vadostane (for a shorter the unproductive period) is a significant precocity character with special economic implications, which had averages of 526 days, respectively, 810 days.

The milk produced by all three strains was a good quality, but in terms of quantity the best was from the Valdostana Pezzata Rossa. Milk yield and qualitive parameters in the 150 days of first lactation was average of 8.7 kg/day, fat content 4.04% and 3.33% protein and main milk production results were for all heifers witch have calved in spring of 2014 was respectively: 2457 kg of 305-day milk production; 99.26 kg of milk fat production and 81.82 kg of milk protein production. Milk urea (MU) 26.21 mg/dl with milk urea nitrogen (MUN), 12.3 mgN/dl. Research on quality of feeding cows in the first lactation a forage ration: in the first 50 days of lactation with enough energy but deficient in protein absorbed at intestinal level (APDN), 100 days of lactation, sowing enough energy and APDN and 150 days of lactating we can notice correct feeding and sufficient energy and correct supply with APD and APDN, with the specification of energy deficit and excess protein is valid for grazing season.

Number of somatic cell showed a low levels during all three control days, being averaged by 165.5 somatic cells/ml x10³, good health mammary gland without sub clinical mastitis and milk obtained from the Valdostana breed is in milk parameters as stipulated by national and EU legislation.

Analysis of reproductive function showed a very good health, calving ease, maternal instinct pronounced and absence ante and postpartum diseases, but should be specified that Valdostana breed (VRP) is more sensitive in reproductive disease occurrence.

We also appreciate that the orientation of a large number of livestock farmers for meat cattle breeding and exploitation, according to the geo-climatic conditions and the increased demand for bovine meat in the European market, can be a solution to revive this important
livestock sector, Romania having a large area of permanent meadows and pastures land, 4.49 million hectares, of which about are 4 mountain and sub-mountainous pastures insufficiently exploited today. However, Romanian farmers have a big problem of competitiveness in the milk sector in the situation of interruption of EU milk quotas in 2015 and with the average production per cow per year is lower (3773 kg/cow/year, FAO 2015) than productions obtained in countries like Nederland, UK, Finland, Sweden and Denmark (with milk production between 7644 kg and 8766 kg /cow /year, but the average specialized dairy breeds in most of EU countries, is more over 10,000 kg / cow).

In Romania, the main challenge is to increase agricultural productivity in a sustainable manner that meets the needs of small farms and creating opportunities for their development where productivity potential of the area is low. At this moment, revitalizing agriculture is difficult or even impossible without the development of the livestock sector by reconsidering the role and place which this sector must have in the national economy.

The general results indicate a good productivity of the breed, especially for beef production and demonstrate that it is very apt to accommodation in the new conditions of breeding from Transylvania region and also resistant to ordinary technology conditions. We can conclude that Valdostana breed raising in Transylvania area from Romanian is suitable for crossing with meat breeds, like Aberden Angus with Valdostana Pezzata Nera (VPN) and Castana breed (CB) or Red Angus with Valdostana Pezzata Rossa (VPR) with good beef production and profitable economic results in EU meat production sector.

5. Acknowledgements

This research paper was made possible by the kindness and involvement SC ModernFarm Jucu farm and Sava farm, who purchased biological material and they understood that must be maintained at least until the first lactation in order to be able determine the economic value and suitability for this breed raised in Transylvania area.

References
16. www.anaborava.it
17. www.insse.ro
18. www.madr.ro