



Milk yield and milk traits in Slovenian sheep breeds

A. Komprej, M. Drobnič, D. Kompan

University of Ljubljana, Biotechnical Faculty, Zootechnical Department, Domžale, 1230 Groblje 3. Slovenia

ABSTRACT

The results for milk recording in Slovenian recorded sheep flocks were studied for the period of last 4 years. 3044 lactations of controlled sheep were analysed. Milk recording is performed according to the regulation of ICAR. Milk yield in Slovenian sheep breeds is evaluated by the method A4. Milk yield is recorded in 3 dairy sheep breeds which are included in Slovenian selection program for small ruminants. It was found out that the number of controlled ewes is increasing from year to year, also the number of included new breeders is increasing and this facts influence on production results. In the observed period a decreasing trend of total milk yield in lactation was noticed. Milk yield also has slightly decreased in separate breeds in the observed period. The lowest milk yield was noticed in Istrian pramenka and the highest milk yield had improved Bovška breed. In the same period, a trend of increasing average fat content was noticed. There were no significant differences in protein content, but the lactose content has decreased. The average fat content in separate breeds increased in Bovška breed (by 0,7%) and in improved Bovška breed (by 0,3%), meanwhile it has decreased in Istrian pramenka (by 0,3%). The lactose content has decreased in Bovška breed and in improved Bovška breed, but in Istrian pramenka it has stayed the same through the years.
(Keywords: sheep, milk, milk content, recording, Slovenia)

ZUSAMMENFASSUNG

Milchleistung und Milcheigenschaften der slowenischen Schafrassen

A. Komprej, M. Drobnič, D. Kompan,

Universität Ljubljana, Biotechnische Fakultät, Abteilung für Zootechnik, Domžale, 1230 Groblje 3. Slowenien

Die Ergebnisse der Milchleistungsprüfung in Schafherden in der letzten vier Jahren in Slowenien wurden ausgewertet. Es wurden 3044 Laktationen untersucht. Die Milchleistungsprüfung verläuft nach ICAR Empfehlungen, A4 Kontrolle. Die Milchleistungsprüfung wurde bei drei Milchrassen, die in das slowenische Schafzuchtprogramm einbezogen sind, durchgeführt. Die Zahl der kontrollierten Schafe und Herden hat sich jedes Jahr erhöht. In der untersuchten Periode ist ein Trend zur Verminderung der Milchleistung zu beobachten. Die höchste Milchleistung erreichte die gezüchtete Bovška Rasse, gefolgt von den Rassen Bovška und Istrien Pramenka. In der untersuchten Periode erhöhte sich der Fettgehalt, während sich der Laktosegehalt verringerte, aber der Proteingehalt unverändert blieb. Der Fettgehalt stieg bei der Bovška Rasse um 0,7% und bei der veredelten Bovška Rasse um 0,3% an, während er bei der Istrien Pramenka Rasse

um 0,3% zurückfiel. Der Laktosegehalt verringerte sich bei der Bovška- und der veredelten Bovška-Rasse, während er bei der Rasse Istrien Pramenka konstant blieb.
(Schlüsselwörter: Schafe, Milch, Milchinhalt, Kontrolle, Slowenien)

INTRODUCTION

70% of agricultural land in Slovenia is classified into land category with limited factors. More than 60% of agricultural land are grassland (meadowland) and pastureland which can be used only by ruminants and horses. Conditions for production on most of this land are difficult and they are poorly suited for farming.

In the last decades this land has been given up and overgrown with bushes and small trees. Sheep and especially goat breeding was reduced after the year 1945 and this contributed to overgrowing the agricultural land in mountainous and alpine land. In the last decades around 300.000 ha of agricultural land has been overgrown (*Kompan, 1996*).

Today, smaller farmers decide for sheep breeding on mountain, alpine and karst regions, where they have stopped with cattle breeding. Delivering of milk on mountain and alpine farms has become questionable owing to small herds and high costs. In this case sheep breeding substitutes cattle breeding although the tradition of cattle breeding is still quite strong and it impedes sheep breeding. In many places sheep breeding is the last alternative before overgrowing the farms (*Kompan, 1998*).

Sheep's milk is a substance of high biological value, whose chemical composition, particularly the protein content, is of great technological and economic importance for the dairy industry (*IDF Bulletin, 1981*).

In most regions of the world, sheep are raised for meat, wool or hide production and are never milked. However, in the region bordering south western Asia, southern Europe and northern Africa – the Mediterranean region and the Middle East ewe milk is widely practised (*Boyazoglu and Treacher, 1978*). One of the Mediterranean dairy sheep breed, Istrian pramenka, is also bred in Karst and primorska region in Slovenia. Due to specific climate in this area, with summer droughts and lack of pasture, traditional technology of dairy sheep and goat breeding with season lambings in January and February developed. Milking of these sheep takes place from April until July, mostly in the mountains. The other dairy sheep breed in Slovenia is bred in Bovec region where are specific harsh climate conditions (*Kompan et al., 1995*).

Contrary to cow's milk, ewe's milk is seldomly used for direct human consumption. Traditionally, ewe's milk is consumed in the form of products, such as cheese and yoghurt. This converted dairy output consists of a variety of local specialities, ranging from high-quality luxury products in the northern Mediterranean region, to those that form an important popular component of everyday consumption (e.g. yoghurt and feta-type cheese). In agro-economically under-privileged areas, where sheep milking is practised (e.g. the Sahel region and North Africa), the milk of small ruminants can be considered as an indispensable source of animal protein (*Boyazoglu, 1982*).

Many factors have influence on quantity, composition and characteristics of the milk. Some of these factors are genetic (amongst breeds, flocks and individuals), fiziological (period of lactation, age, state of health) and some of them are environmental (nutrition, climate, season, the method of milking, management with the animal etc.). The composition of the milk determines its nutritional value, quality for suitability into milk products etc. Due to high contents of dry matter, especially fat and proteins, sheep milk has almost twice

the cheesemaking efficiency then cow's or goat's milk. *Table 1* shows approximate composition of cow's, goat's and sheep milk (Rogelj, 1996).

Table 1

Approximate composition of cow's, goat's and sheep milk

Component (%) (1)	milk (2)		
	cow's (3)	goat's (4)	sheep (5)
Dry matter (6)	12,7	13,8	18,5
Fat (7)	3,8	4,4	7,2
Proteins (8)	3,5	4,1	5,7
Lactose (9)	4,8	4,4	4,3

Source (*Quelle*): Rogelj, 1996

1. Tabelle: Zusammensetzung der Milch von Kühen, Ziegen und Schafen

Komponente(1), Milch(2), Kühe(3), Ziegen(4), Schafe(5), Trockensubstanz(6), Fett(7), Protein(8), Laktose(9)

MATERIALS AND METHODS

Milking and milk recording

Slovenia has been a member of International Committee for Animal Recording (ICAR) since 1986. Therefore milk recording has to be performed according to the regulation of ICAR which allows several methods. Milk yield in Slovenian sheep breeds is evaluated by the method A4.

Data for milk yield are collected at dairy ewes which are recorded according to the rules of the Slovenian selection program for small ruminants. The following dairy breeds are included in this program: Bovška (B) and Istrian pramenka (IP) dairy breeds, a subpopulation of Bovška breed is improved with East-Friesian dairy breed (VFB).

Daily milk yield was recorded once monthly during the evening and morning milkings. Milk yield in lactation was calculated by summing milk yield during the suckling period and milk yield during the milking-only period. Milk yield during the suckling period was calculated on basis of lamb weight gain from lambing to weaning. Milk yield during the milking period was obtained by multiplying daily milk records by the number of days between weaning and first recording day, for the first period, and by the number of days since the preceding milk recording day for subsequent recording days. Only lactations with at least three monthly records were included in the analysis (ICAR, 1992).

The aim of the study was to analyze milk yield and selected milk traits (fat-percentage, protein-percentage, lactose-percentage, dry matter-percentage) in Slovenian sheep breeds. Data analysed were obtained from the central database of the Slovenian selection program for small ruminants (*Drobnič and Kompan, 1995*).

Analysed sheep breeds

In 1998 dairy sheep breeds presented 23% of the total number of recorded sheep in Slovenia. Sheep milk is produced in a much smaller quantity then cow's milk in Slovenia. The most important product obtained from the sheep milk is cheese.

The prevailing recorded dairy sheep breed in Slovenia is Bovška breed (61% in 1998). The rest are represented in much smaller proportions, 22% of Istrian pramenka and 14% of Bovška improved and those left are crossbreeds.

In 1981, Biotechnical Faculty in Slovenia imported a small flock of ewes and rams of East-Friesian sheep. They were imported to improve prolificacy, milk yield and quality of wool in a subpopulation of Slovenian native Bovška sheep.

East-Friesian sheep are considered to be the world's highest producing dairy sheep, kept in very small flocks (1-5 ewes) in their region of origin. They are highly specialized animals and do not do well under extensive conditions and larger flocks. The pure-bred East-Friesian adapt poorly to the dryland and high temperature conditions of the Mediterranean and para-Mediterranean ecosystem (*Boyazoglu et al., 1979*).

The rearing of pure-bred East-Friesian sheep in Slovenia didn't succeed. Crosses between Bovška sheep and East-Friesian sheep also didn't do well under Slovenian husbandry conditions. Improved Bovška sheep didn't attain much higher milk yield than the native Bovška sheep and there were quite a lot of health problems because of harsh climate conditions in the Bovec region. Widening of improved Bovška breed into new rearings has to be careful for poor conditions of rearing, maintenance and feeding, because of high losses, but milk production results are often lower than in pure-bred Bovška breed. Improved Bovška sheep has kept just in some intensive rearings, where they have chances for producing and conserving food. The most breeders returned to native Bovška sheep breeding.

RESULTS AND DISCUSSION

Milk yield in recorded sheep

Milk recording results of Slovenian sheep breeds were analysed for the studied period. 3044 lactations of controlled ewes have been evaluated. The number of recorded ewes has increased by the years from 489 to 974 (*Table 2*). The number of sheep breeders in Slovenian selection program is still increasing. These facts influence on production results which could be unpredictable. *Table 2* shows the average milk yield in lactation of all recorded ewes in the period between the years 1995 and 1998. Total milk yield in lactation decreased from 227 kg in 1995 to 199 kg in 1998. The fat-percentage increased from 5,8 to 6,4. In various sources (EAAP, 1983) was mentioned that the content of fat is reputed to vary from about 6% to just under 8%. The average fat content in all recorded sheep in Slovenia was under 6% in the years 1995 and 1996. The same sources mentioned that the protein content is estimated at 5-6%. The protein content in Slovenian sheep was around 5%. The content of lactose in Slovenian sheep decreased during the observed period from 4,8 to 4,3%.

From 1995 to 1998, there is a trend of decreasing total milk yield (*Figure 1*). The reason for decreasing milk yield is probably due to including more number of native breed Istrian pramenka in Slovenian selection program for small ruminants and also because of including more number of new breeders in the Selection program.

Due to the same reason, the components of the milk probably ranged. There is an increasing trend of the average fat content in milk and a decreasing trend of the average lactose content in the observed years (*Figure 2*).

Milk yield by breeds

During the observed period, the number of recorded Bovška sheep increased more than twice (*Table 3*). Data show that the average total milk yield per ewe decreased by 17 kg in the mentioned period (*Table 3, Figure 3*). *Table 3* also shows that content of fat increased

notably. There were no significant differences in content of proteins, except in the year 1996. The content of lactose decreased from 4,8 to 4,3%. Lactation length was the longest in the year 1998 (227 days).

Table 2

Average milk yield in lactation of all recorded ewes in the period

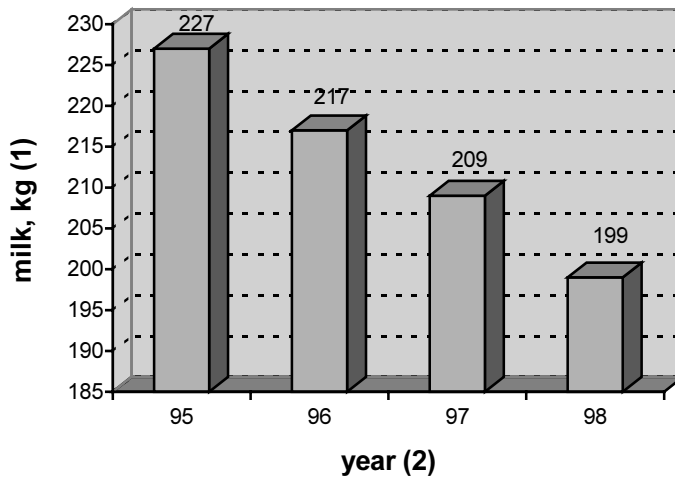
Year (1)	No. of ewes (2)	Total milk yield, kg (3)	Fat, % (4)	Proteins, % (5)	Lactose, % (6)	Dry matter, % (7)	Lactation, days (8)
1995	489	227	5,8	5,1	4,8	15,7	202
1996	743	217	5,9	4,7	4,4	14,7	191
1997	838	209	6,2	5,1	4,4	15,8	187
1998	974	199	6,4	4,9	4,3	15,6	194

2. Tabelle: Durchschnittliche Milchleistung der untersuchten Schafe in einer Laktation

Jahr(1), Anzahl der Mutterschafe(2), Milchleistung kg(3), Fett %(4), Protein %(5), Laktose %(6), Trockensubstanz %(7), Laktationstage(8)

Figure 1

The average total milk amount of all recorded ewes in Slovenia in years 1995-1998

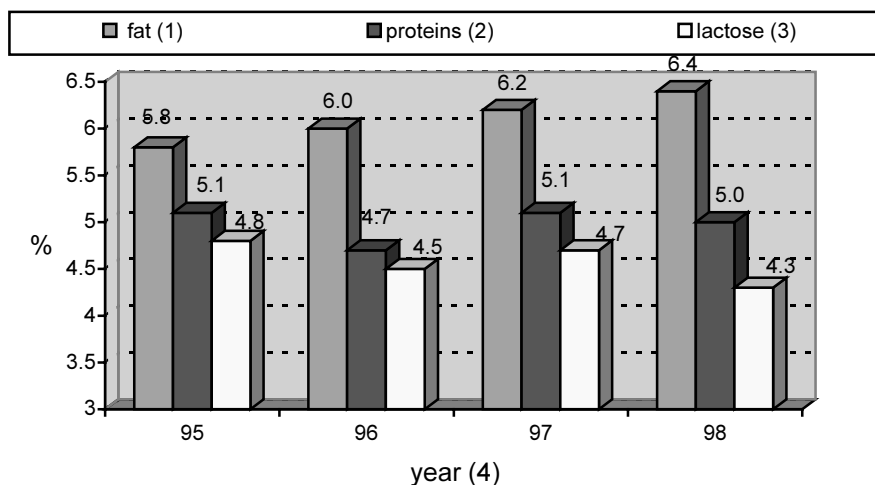


1. Abbildung: Durchschnittliche Milchleistung aller kontrollieren Schafe in Slowenien von 1995-1998

Milch(1), Jahr(2)

Figure 2

The average contents of fat, proteins and lactose of all recorded ewes in Slovenia in years 1995-1998



2. Abbildung: Durchschnittlicher Gehalt an Fett, Protein und Laktose bei allen kontrollierten Schafen in Slowenien von 1995-1998

Fett(1), Protein(2), Laktose(3), Jahr(4)

Milk yield by breeds

During the observed period, the number of recorded Bovška sheep increased more than twice (Table 3). Data show that the average total milk yield per ewe decreased by 17 kg in the mentioned period (Table 3, Figure 3). Table 3 also shows that content of fat increased notably. There were no significant differences in content of proteins, except in the year 1996. The content of lactose decreased from 4,8 to 4,3%. Lactation length was the longest in the year 1998 (227 days).

Ogrizek (1948) estimated milk yield in lactation of Bovška sheep only from 65 to 80 kg. But Mlekuž (1996) mentioned that milk yield in the last years has increased due to better feeding, management and health. He also mentioned that some breeders milk about 200 kg of milk and lambs suck it still about 50 kg. Sheep are rarely feed with concentrates. On the pastures, they are often without water and they get salt only once a week. These facts quite often limit their milk yield. He also mentioned that the fat content is around 6,5%.

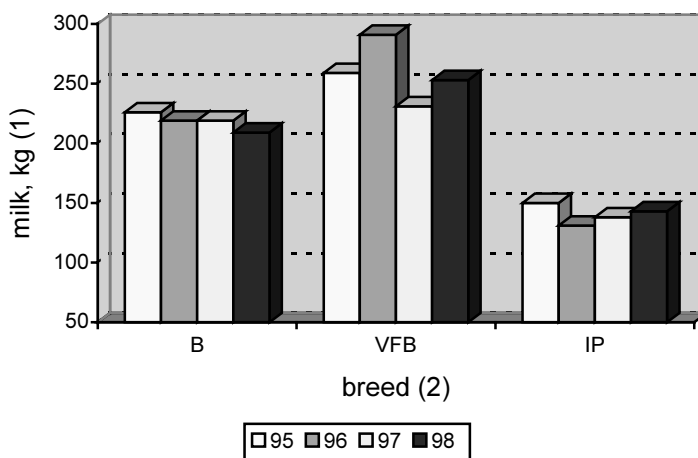
The number of milk recorded improved Bovška sheep also increased in the period between 1995 to 1998. Table 4 shows that the average total milk yield decreased from 259 to 253 kg, although the milk yield was almost 300 kg in the year 1996 (Figure 3). Table 4 shows also the content of fat, proteins, lactose and dry matter in milk of the recorded sheep. The fat content increased by 0,3% in the mentioned years, and the lactose content decreased by 0,4%.

Table 3**Average milk yield of recorded Bovška sheep in the period between years 1995 and 1998**

Year (1)	No. of ewes (2)	Total milk yield, kg (3)	Fat, % (4)	Protein, % (5)	Lactose, % (6)	Dry matter, % (7)	Milking days (8)
1995	261	226	5,6	5,1	4,8	15,5	181
1996	477	219	5,8	4,7	4,6	15,0	173
1997	566	219	6,1	5,1	4,4	15,6	178
1998	598	209	6,3	4,9	4,3	15,4	227

3. Tabelle: Durchschnittliche Milchleistung der untersuchten Bovska-Schafe von 1995-1998

Jahr(1), Anzahl der Mutterschafe(2), Milchleistung kg(3), Fett %(4), Protein %(5), Laktose %(6), Trockensubstanz %(7), Laktationstage(8)

Figure 3**Average milk yield of recorded ewes by the separate breeds in years 1995-1998**

3. Abbildung: Durchschnittliche Milchleistung von kontrollierten Schafen unterschiedlicher Rassen von 1995 - 1998

Milch(1), Rasse(2)

Results of milk yield in improved Bovška sheep could be comparable with results which Gootwine and Goot (1995) obtained. In several Mediterranean countries, local dairy breeds (Awassi) have been crossed with East-Friesian rams to improve fertility and milk yield. Gootwine and Goot found out that milk yield of the Awassi, Awassi X EF (F1), F1XF1 (F2) ranged from 223 to 248 kg. The East-Friesian had the lowest milk yield (161 kg, only 65% of the milk yield of the Awassi breed).

Table 4

Average milk yield of recorded improved Bovška sheep in the period between years 1995 and 1998

Year (1)	No. of ewes (2)	Total milk yield, kg (3)	Fat, % (4)	Protein, % (5)	Lactose, % (6)	Dry matter, % (7)	Milking days (8)
1995	86	259	5,8	4,9	4,8	15,5	229
1996	122	291	6,1	4,8	4,5	15,4	233
1997	138	231	6,0	5,0	4,6	15,6	218
1998	133	253	6,1	5,0	4,4	15,4	227

4. Tabelle: Durchschnittliche Milchleistung der veredelten Bovska-Schafe von 1995-1998

Jahr(1), Anzahl der Mutterschafe(2), Milchleistung kg(3), Fett %(4), Protein %(5), Laktose %(6), Trockensubstanz %(7), Laktationstage(8)

The number of recorded Istrian pramenka also increased by 171 ewes from 1995 to 1998 (Table 5). Data show that milk yield of Istrian pramenka was much lower than milk yield of Bovška and improved Bovška sheep in this period (Figure 3). The milk yield of Istrian pramenka decreased in the mentioned period by 7 kg. The content of fat was higher at Istrian pramenka then at Bovška and improved Bovška sheep, although it decreased by 0,3% in the mentioned period. The content of lactose was lower at Istrian pramenka then at the others.

Kompan (1996) mentioned that in average breeding conditions, the Istrian sheep gives between 100 and 150 kg of milk in lactation with 9% of fats and more than 6,4% of proteins. In Slovenia, there are from 400 to 500 Istrian sheep, which are included in Program of Conservation of Native Slovene Breeds of Domestic Animals. The content of dry matter was pretty higher in the milk of Istrka pramenka than in the milk of the other observed breeds.

Table 5

Average milk yield of recorded Istrian pramenka in the period between years 1995 and 1998

Year (1)	No. of ewes (2)	Total milk yield, kg (3)	Fat, % (4)	Protein, % (5)	Lactose, % (6)	Dry matter, % (7)	Milking days (8)
1995	45	150	7,2	5,8	4,1	16,7	229
1996	87	131	7,4	5,1	4,1	16,6	210
1997	99	138	7,4	5,5	4,1	17,0	185
1998	216	143	6,9	5,2	4,1	16,2	202

5. Tabelle: Durchschnittliche Milchleistung der Istrian-Pramenka-Schafe von 1995-1998

Jahr(1), Anzahl der Mutterschafe(2), Milchleistung kg(3), Fett %(4), Protein %(5), Laktose %(6), Trockensubstanz %(7), Laktationstage(8)

CONCLUSIONS

In the last decades around 300.000 ha of agricultural land in Slovenia has been overgrown. Conditions for production on most of mountain and alpine land are not useful for farming. In many places sheep breeding is the last alternative before overgrowing the farms.

Dairy sheep breeding in Slovenia is important at Karst and Primorska region due to specific climate.

Milk yield in Slovenian sheep breeds is recorded according to the regulations of ICAR and it is evaluated by the method A4.

During the observed period the number of all recorded ewes was increasing. The number of included sheep breeders is still increasing. The most prevailing dairy sheep in Slovenia is Bovška breed.

Between the years 1995-1998 the total milk yield in Slovenian sheep breeds has decreased. The milk yield by separate breeds also decreased in the observed period; by 17 kg in Bovška breed, by 6 kg in improved Bovška breed and by 7 kg in Istrian pramenka. The Istrian pramenka had the lowest milk yield in all observed years and the improved Bovška sheep had the highest milk yield.

The fat content in Slovenian sheep breeds has increased in the observed period. It has also increased in Bovška breed (by 0,7%) and in improved Bovška breed (by 0,3%), but it has decreased in Istrian pramenka (by 0,3%). The Istrian pramenka had the highest fat content and the lowest lactose content in the milk in all observed years.

The results of milk yield in Slovenian sheep breeds show that there is still quite a lot of possibilities to improve the milk yield. Nutrition, maintenance and state of health can contribute to improve the production and to influence on rearing success.

REFERENCES

- Boyazoglu, J.G., Treacher, T.T. (1978). Milk production in the ewe. E.A.A.P. Publication, 23. 156.
- Boyazoglu, J.G. (1982). The animal as a food resource for man. Proc. 3rd Int. Conf. on Goat Production and Disease, Tuscon, 10-15.
- Boyazoglu, J.G., Casu, S., Flamant, J.C. (1979). Crossbreeding the Sardinian and East-Friesian breeds in Sardinia. Ann. Génét. Sél. Anim., 11. 23-51.
- Drobnič, M., Kompan, D. (1995). An information system for small ruminants. Zb. Bioteh. Fak. Kmetijstvo (Zootehnika), Ljubljana, 66. 7-12.
- Gootwine, E., Goot, H. (1996). Lamb and milk production of Awassi and East-Friesian sheep and their crosses under mediterranean environment. Small Ruminant Research, 20. 255-260.
- International Committee for Animal Recording (ICAR) (1992). International Regulations for Milk Recording in Dairy Sheep, Roma, 15.
- IDF Bulletin. (1981). The composition of Ewe's and Goat's milk. International Dairy Federation, 140.
- Kompan, D., Pogačnik, M., Kotar, M. (1995). Uporaba avtohtonih mlečnih pasem ovc za kultiviranje opuščenih kraških senožeti. Sodobno kmetijstvo, 28. 5. 230-234.
- Kompan, D. (1996). Perspektive reje drobnice v Sloveniji. Drobница, 1. 4-5.
- Kompan, D., Brežnik, S., Birtič, D. (1998). Rezultati kontrole in selekcije v preteklem letu pri drobnici. Drobница, 1. 3-5.

- Kompan, D., Erjavec, E., Kastelic, D., Kavčič, S., Kermauner, A., Rogelj, I., Vidrih, T. (1996). Reja drobnice. Ljubljana, ČZD Kmečki glas. 309.
- Mlekuž, J. (1996). O bovški ovci. Drobnica, 1. 12-13.
- Ogrizek, A. (1948). Ovčarstvo. Zagreb, Ilica br. 30. Tiskara knjižare st. Kugli. 268.
- Rogelj, I. (1996). Lastnosti in sestava ovčjega in kozjega mleka. Drobnica, 2. 3-5.

Corresponding author (*Adresse*):

Andrija Komprej

University of Ljubljana, Biotechnical Faculty
1230 Domžale, Groblje 3. Slovenia
Universität Ljubljana, Biotechnische Fakultät
1230 Domžale, Groblje 3. Slowenien
Tel.: +386-61-717-810, Fax: +386-61-721-005
e-mail: silvo.zgur@bfro.uni-lj.si