BUFFALO LIVESTOCK AND PRODUCTS IN EUROPE

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Abstract

Buffalo livestock and strategies are reported for all the countries in Europe, where buffalo specie is reared and used for food production, as Italy, Romania, Bulgaria, Germany, Macedonia, United Kingdome, Greece, Serbia, Albania, Ukraine, and Hungary.

Particularly Italy situation is discussed as in this country selection, milk recording and production, management, nutrition and reproduction techniques, quality food and marketing are really developed at top level.

In Italy 50,000 buffaloes are recorded every month during the lactation, showing a milk yield of 2,220 kg in 270 days of lactation with 8.4% fat and 4.6% protein, as many champions produce more than 5,000 kg for lactation. Artificial insemination is largely applied.

The National Association of Italian Buffalo breeders was instituted on 1979, the Buffalo Genealogical Book for the Mediterranean Italian Buffalo Breed on 1980, the famous mozzarella cheese obtained the Denomination Origin Protected on 1993, with Decree of Agricultural Ministry, approved by European Union, where milk and mozzarella characteristics are defined for consumer guarantee.

In Italy 400,000 buffaloes are managed and fed in intensive system: the females are kept loose in paddock and mechanically milked twice a day; the males are managed in feed-lots or on slatted floor stables for fattening and are slaughtered at 15 months, achieving more than 400 kg live weight. Even if many products are appreciated coming from milk, as ricotta, provola, scamorza, treccia and other cheeses, or coming from meat, as steaks, roast, ham, bresaola, salami, the most important product in the Italian and international market is mozzarella, of which 36,000 tons are produced every year, with a value of 500 million euros. The consumption is 82% in Italy, 18% for export, particularly for Germany, France, USA, UK.

Keywords: buffalo livestock, management, products, Mediterranean Italian breed.

Introduction:

The buffalo population and economy in Europe shows two different trends: an increasing trend in Italy, where population, genetics, technologies, high quality products from both milk and meat lines and market are in progressing, and a decreasing trend in the most of other countries, where a draught animal disappeared as mechanization was introduced, without a selection of a dairy buffalo breed. Other countries more, where in the past buffalo species was not known, introduced dairy buffaloes, particularly from Italy, to create a new buffalo market, as U.K. and Germany.

1. ITALY

1.1. Selection, milk recording and production

Buffalo Genealogical Book was instituted by Italian Ministerial Decree on June, 23, 1980 and was held by A.I.A.(Italian Association of Breeders).

The A.N.A.S.B. (National Association of Buffalo Species Breeders) had been instituted on 1979 and recognized on the 1994 by Agricultural Ministry.

The Ministry, with Ministerial Decree n° 20154 has entrusted the management of the Book to A.N.A.S.B. on year 2000. In the same year other decree (D.M. 201992 on July,5, 2000) recognized buffalo enrolled in Genealogical Book pertaining to the only own race: "Mediterranean Italian" (figure 1).

The animals rose in Campania and in Lazio Regions of Italy give the milk used for the production of the famous "Mozzarella di Bufala Campana D.O.P. " (figure 2). The D.O.P. (Denomination Origin Protected) Mozzarella di Bufala Campana was recognized with the Ministerial Decree on May 10, 1993, published on the G.U. n.219 on 17/9/1993, and after from European Union; that means that this cheese mozzarella has to be produced in defined areas of the Provinces of Caserta, Salerno, Benevento, Napoli, Frosinone, Latina, Rome,(Foggia was added after), coming only from fresh milk of buffalo cows of Mediterranean Italian breed, registered in the Buffalo Genealogical Book. The Decree establishes the milk characteristics (fresh within 16 hours from milking, raw, minimum fat 7%,), processing techniques (acidification, coagulation, stretching, moulding) and mozzarella characteristics. The logo is represented in figure 3. The control and guardianship is effected by "Consorzio per la tutela del formaggio Mozzarella di Bufala Campana", so the European consumer is guarantee that the logo means a quality product of the made in Italy, according the best standard of animal management, welfare and health, according also the best characteristics of mozzarella, as sanity, freshness, flavour and juiciness.

The main factors that have contributed to the development of buffalo in Italy in the past few years have been the following: no regimen of milk quotas; increase of the consumption of mozzarella in Italy and export in many countries in the world; the high price of buffalo milk (about 1.20 euro/ kg) in comparison with cattle milk (about 0.40 euro/kg), the high technology of farmers, high level of management and breeding, high genetic value of the herd, obtained by performance and progeny testing, animal recording and selection, artificial insemination applying, starting with an organization born more than 50 years ago.

Several cycles of progeny tests, with the publication on 1997 in the first time, of the genetic indexes of breeders of buffalo species, both males and females, are effected by ANASB.

The execution of the milk recording in buffalo is applied according ICAR (International Committee for Animal Recording, Moioli, 2005), according to the Regulations of the Buffalo Species and to the norms emanated in the Central Technical Committee of the milk recording

of the bovines and the buffaloes. For being able to be subordinate to the control, as a result of completely voluntary adhesion, the farms must fulfil to some prescriptions: they must be subordinate to the inspection from an expert of race of A.N.A.S.B. ; they must possess the sanitary certificate from National Sanitary System that attests its indemnity and must have the bulls with genealogical certificate in order to admit they to service.

For Mediterranean Italian Buffalo, the productive controls regard: the quantity of milk in kg, the determination of the percentage of fat and of proteins (kg and %) and the somatic cells.

The beginning of the official lactation starts at calving; the first control cannot be carried before the five days from calving and not beyond 75 days. The duration of the reference lactation is 270 days; in any case the duration of the effective lactation must be indicated.

Every milk control must be made on all the milking ordinarily practiced by the breeder in the 24 hours, annotating also the hour in which the same control is carried out, the quantity of milk found must be indicated in kilograms, the milk must be weighed with the balance or be determined with lactometers.

For every subject are reported the following data: number of current lactation, daily production expressed in kg milk, % fat, % proteins and number of somatic cells, the effective production from the calving for: kg milk, kg fat and proteins and the daily medium production, the milk production in comparison to the reference lactation of 270 days, "equivalente bufala matura" (E.B.M.) expressed in kg of milk, fat and proteins (Coletta and Caso, 2008).

E.B.M is a hypothetical production for a buffalo that started his lactation in January at five years old; the productive ability is the ratio between E.B.M. of the single buffalo and the mean I.B.M. of the farm.

All data are collected by ANASB, which decides on the selection goals which are presently to increase not only the milk quantities but specifically the mozzarella cheese production according to the mozzarella index:

Mozzarella (kg)= Milk (kg) x (3.5 x % proteins + 1.23 x % fat – 0.88) / 100

Figura 1. Mediterranean Italian breed, Tor Mancina farm, Rome (Borghese photo 2006).

Figure 2. Mozzarella and the colours of Italian flag: green, white, red.

Figure 3. Logo of Mozzarella di Bufala Campana DOP

In Italy there are 370 000 buffaloes and the mean milk production is over 2200 kg for lactation, in confront of other Mediterranean countries where the maximum production is less than 1900 kg. In Italy the milk production in 46,799 recorded buffaloes (ANASB, 2009) was 2 221 kg (8.24 % fat and 4.66 % protein) in 270 days of lactation (Table 1). Recorded buffaloes are raised in 290 herds with an average of 161.3 head per farm.

Table 1. Italian Buffaloes (ANASB 2009)

N° Head	370 000
N° Dairy buffaloes	180 000
N° Recorded buffaloes	46 799
% Recorded Buffaloes	26.0
N° Recorded farms	290
N° Head/farm	161.3
kg milk production (in 270 d)	2 221
% Fat	8.24
% Protein	4.66

In the year 2010 milk production in 270 days of lactation was 2180 kg with 8.47% fat, 4.59% protein. The recorded buffaloes were 50,240 with an increasing of 7.35% (ANASB, 2011).). In the year 2011 the milk production was 2134 kg with 8.4% fat and 4.7% protein on 54,548 recorded buffaloes, with a further increasing of 8.57% on recording extension.

In other countries the buffalo productivity is lower, due to the fact that only Italy has undertaken a great deal of work on recording, on selection, on reproductive and genetic improvement, on health, on feeding and livestock systems, as is shown in the following analysis.

The recorded buffalos on year 2006 were 40.425, with an increase of 1,2% regarding 2005.

In figure 4 is clearly evinced how the buffalo head number increased in the period 1981 – 2006 and this is the basis for the genetic development and the milk capacity improvement.

On the basis of 26,462 considered lactations, we found on 2006 an average production of kg 2.178 with fat average of 8,09 % and a proteins average of 4.67%. (Coletta and Caso, 2008).

In the reported period, the average production expressed in kg, has been increased slowly but constantly from 1990 with 1893 kg for lactation until 2004 with 2184 kg for lactation, until 2009 with 2221 kg for lactation.

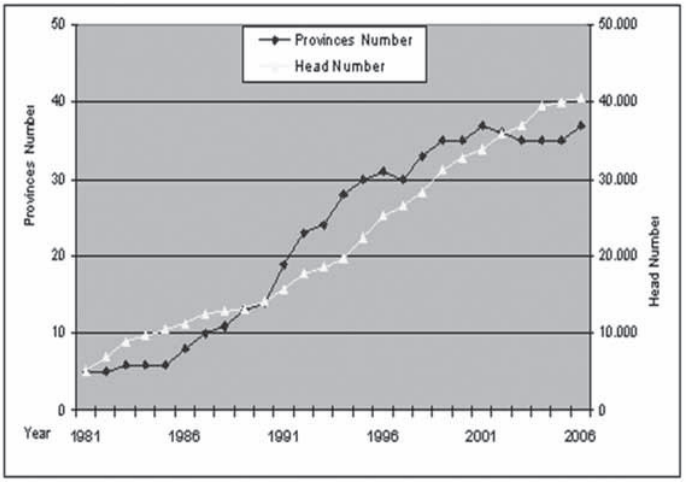

Figure 4. Recorded Buffaloes in the years 1981-2006 (Coletta and Caso, 2008).

In the last few years, in Italy, milk composition has been improved: the average protein content has raised from 4.4% in 2002 to 4.6% in 2010 while the average fat content raised from 7.3% in 2002, to 8.5% in 2010, without operating any selection for the character of protein and fat content. Moreover the possibilities for genetic improvement for milk quantity and quality will be higher, if the selection pressure will be increased reducing the number of bred females, discarding the low productive females. At the present time there are many females in Italy producing more than 5,000 kg milk/270 days of lactation) until the maximum production of 5600 kg with 8.32% fat and 4.63% protein.

There are in Italy two Bull Buffalo Centres for semen production: the COFA (Cooperativa Fecondazione Artificiale) in Cremona Province, Lombardia Region, in North of Italy, where there are many bulls with genetic potential to produce more than 4000 kg milk/ lactation as Malandrino Bull and O-B-One Bull lines. The Chiacchierini Bull Centre in Perugia Province, Umbria Region, in Middle Italy: this one started a genetic selection programme with CIPAB consortium and actually produces semen from 16 tested bulls from different bloodlines, coming from mothers over 3100 kg milk yield per lactation with more than 4.5% protein: there are Ciripicchio Bull with 4494 kg milk/lactation and Jesce Sole Bull with 4157 kg milk/ lactation, as recorded in the best daughters, and Brillante, the best bull for pedigree index of 2010-2011 progeny test. This stud is one of the few European A.I. studs authorized as insect-proof quarantine barn, located away from the semen production zone. It is authorized for worldwide export for the excellent sanitary level. Chiacchierini Bull Centre produces sexed semen too, available from a lot of bulls.

Hereafter the selection will be directed at the improvement of the yield of mozzarella cheese, not simply for milk production, since the farm income is based firstly on mozzarella cheese, secondly on the sale of pregnant heifers, lastly on beef sales and finally on the sale of semen and embryos of high genetic value.

The largest proportion of the buffalo population can be found in Provinces of Caserta and Salerno (Campania region), and the next localities for size of population are the Provinces of Frosinone and Latina (Lazio region), which are in the Denomination of Protected Origin (D.O.P.) area.

The control and monitoring of pathologies is affected by the local veterinary services and by the "Istituto Zooprofilattico Sperimentale" (Animal Prophylaxis Research Institute), one for the Lazio region and another for the Campania region. The hygienic control of the milk production and of the milk products in the industry is of a particularly high standard.

Research on the buffalo species is carried out by the Animal Production Research Institute, Monterotondo, Rome, where are the General Secretary of the International Buffalo Federation (IBF) and the FAO Inter-Regional Cooperative research Network on Buffalo that publish the Buffalo Newsletter, and by the Federico II University, Naples.

1.2. Management and nutrition

Italian buffalo management is today exclusively intensive, as in the past it was extensive too with calves milking from cows in the open air (figure 5) separately or together with milking man by hands. This figure is disappeared, now existing only intensive system: dairy buffaloes are kept loose in paddocks close to the milking room, where the cows are submitted to udder control and mechanically milked twice a day. The females are normally artificially inseminated in the paddock, using high genealogy semen, preferably in February-March after oestrus induction, to obtain calving before spring (about 50% fertility), as the milk is paid more in spring and summer according the consumer demand. After one month from

artificial insemination the empty females are naturally mated (figure 6), obtaining another 30% fertility with a total mean fertility rate of 80%.

The buffalo cows are selected too for udder and teat conformation and adaptability to milking machine (figure 7).

Milk production is sustained by diets with a high energy (from 0.85 to 0.95 MFU/kg dry matter-DM) and a high protein concentration (14-16 % crude protein on DM), based on maize and other silages, cereal grains, soya, alfalfa or "graminaceae" hay and by-products. The feeding stuffs movement and distribution is effected by mixing trucks along the feeding line in paddock or in feed-lots (figure 8); the movement and stocking of dung is also mechanized; therefore there are no smallholders in Italy, but only farmers with an average herd size of 161.3 head per herd. Heifers are also fed intensively in order to achieve puberty before 20 months (Borghese et al., 1997, Borghese, 2005). The heifers are housed loose in paddocks all year long, utilizing the same modern systems used for dairy cows.

In intensive systems the buffalo cows normally receive unifeed composed of maize silage, concentrates, hay, straw and sometimes by-products. For example, a 600 kg live weight buffalo cow producing 10 kg milk, would be fed 15.3 kg DM (33 % maize silage, 42 % alfalfa hay, 8 % maize grain and 17 % concentrate with 38 % proteins,) with 12.7 Milk Feed Units (FU), 2.1 kg crude proteins and 3.5 kg crude fibre. Maize silage can be highly increased: some rations foresee until 60% maize silage, 26% concentrates, 14% hay and straw, sometimes by products (tomato peel, brewer grain residuals, sugar beet pulp) (Borghese, 2010).

Experimental diets (Barile et al., 2010) were carried out with maize or sorghum silages (16% on DM): in the first diet maize silage was 71.2%, alfalfa hay 9.3, concentrate 19%; in the second diet sorghum silage was 60.9%, alfalfa hay 10.1%, concentrate 28.5%. In both groups milk FU/kg were 0.9, crude protein 15.6%, crude fibre 21.2% on DM. Both diets produced more than 8 kg milk/head/day (8.03-8.78 respectively with maize or sorghum) with 8.74-8.47% fat and 4.98-4.78% protein respectively during lactation 270 days long.

The calves are normally taken off the mothers, they receive colostrum in the biberon (particular bottle) and after reconstituted milk, in single cage 1 or 2 months after birth, to avoid infections and to control the consumption, after in multiple boxes (figure 9), where the calves receive milk replacers, starter concentrates and good hay until the weaning (about 3 months for males, 3-5 months for females). The males follow the meat line and they are managed in feed-lots or in slatted floor stables for fattening (figure 10), as the females are preferably managed in open air, especially if pasture is available.

Figura 5. Extensive system: calf with cows. Tor Mancina farm, Rome (Borghese photo 2006).

Figure 6. Intensive system with mating. Tor Mancina farm, Rome (Moioli photo 1994).

Figure 7. Beautiful Mediterranean Italian Buffalo cow in intensive system. Tor Mancina farm, Rome (Borghese photo 2006).

Figure 8. Intensive system: feed-lot. Tor Mancina farm, Rome (Borghese photo 2006).

Figure 9. Calves managed in box.

Figure 10. Intensive system for fattening. Tor Mancina farm, Rome (Borghese photo 2006).

1.3. Buffalo food and market

The largest proportion of the buffalo population is localized in Provinces of Caserta and Salerno (Campania Region), and the next localities for size of population are the Provinces of Frosinone and Latina (Lazio region), which are in the Denomination of Protected Origin (D.O.P.) area .

The hygienic control of the milk and milk products in the industry is of a particularly high standard.

The market is mainly based on mozzarella cheese, very famous one, not only for the local consumption according the traditional Italian cooking style, but also in many foreign countries. There are different types of mozzarella, the best one is produced in D.O.P. area (figure 12) according the regulations: it is hand made by raw buffalo milk, soft, juicy and tasty, rich of live ferments, natural yeasts and microbes, it is coming from a difficult processing schedule, particularly for stretching phase (figure 11), it changes taste during time, not preserving in fridge but in mozzarella water and the shelf life is about 5 days. The industrial mozzarella, even if produced in D.O.P. area according the regulations, is made by machines and microbes die during pasteurization, with the advantage of a longer shelf life, preserving in fridge (until

more than 2 weeks) but the material is too compact and the taste is hard and anonymous; this product is distributed in supermarket and for export. After that there is a lot of false mozzarella, produced by mixing buffalo and cow milk or out of D.O.P. regulations. The basic price of mozzarella at cheese industry is 10 euro/kg, with a good profit, utilizing 4 litres of milk/kg mozzarella and starting from the milk price as 1.20 €/litre that is more than 3 times the price of cattle milk. The price in the shop increases as more as the quality of mozzarella and the distance from the site of production until 20-30 €/kg. The market is richer in Campania and Lazio Regions, where is easy to find shop with a lot of products coming from milk and meat industry. The mozzarella D.O.P. consumption is about 82% for the Italian market, 18% for the export, particularly for Germany (20% of the export), France (20%), USA (18%), U.K. (12%) (Borghese, 2005, 2010).

In the year 2010, 36000 tons of mozzarella was produced, with an increase of 12.5% respect to the 2009, with a sales volume of € 300 million at the production, € 500 million at the consumption (Borghese, 2011).

Another very appreciated product is the ricotta (figure 13), that is not really cheese because it is produced boiling the serum proteins remaining after the produced curd.

After mozzarella market, now meat market is rapidly increasing: now there are some fattening centres for the production of excellent buffalo carcasses. Calve carcasses are appreciated for clear and tender meat (figure 14) but normally the live weight at slaughter is 400-440 kg obtained at 15-16 months of age with 800-1000 g/d of daily gain, managed on slatted floor (figure 10) to avoid bad smell of urine and faeces: young bulls without defect or pathologies, beautiful carcasses with conformation R (good), medium fattening (figure 15) according Italian market requirements are obtained, 52% dressing percentage, 57% net dressing percentage, 62% meat on carcass, meat with low fat (less than 3%), very clear, tender and juicy, with good dietetic qualities: <50mg cholesterol /100 g, unsaturated fatty acid/ saturated fatty acid >1, iron >1.5mg/100g.

The first quality cuts are well represented with good muscular growth and are sold at 14-25 €/kg for typical restaurants and many products, as bresaola, salami, cacciatorini are sold in typical shop together with buffalo cheese, as meat also obtained I.G.P. (Indication Geographic Protected) "Carne di Bufalo Campana".

Very appreciated and common products are: mozzarella, treccia, scamorza, crescenza, robiola, caciocavallo and other cheeses, ricotta, yogurt; meat and meat industry products: bresaola, salami, sausages, caciorollo, cacciatorini (little salami) (figure 16).

Finally Italy is a reference point as buffalo importance in human food sustainability for high quality products.

Figure 11. Milk processing and mozzarella production.

Figure 12. Typical Italian Mozzarella di Bufala Campana DOP "Aversana type".

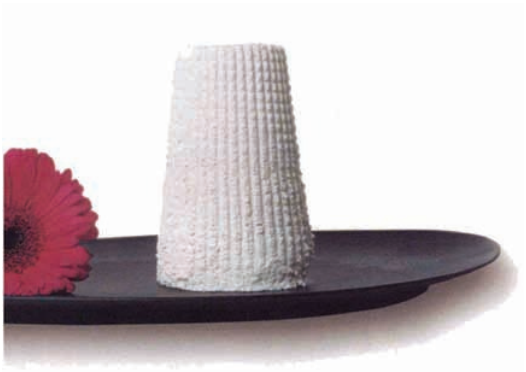

Figure 13. Typical Italian ricotta.

Figure 14. Calves buffalo carcasses.

Figure 15. Rump of young bull with conformation R and fatness 2+ .

Figure 16. Scamorze, bresaola and salami from buffalo.

2. ROMANIA

Despite the fact that the origins of buffalo in the area are unclear, it is sure that they were introduced about 1000 years ago - by perhaps the Crusaders or the Islamic invaders. The buffalo found in the north in the Carpathians were, possibly, introduced 500 years earlier by the Avars (SAVE, 2011). But this theory is not real, because buffaloes coming from Mongolian

countries have to be Swamp subspecies; on the contrary Romania buffaloes are typical Mediterranean, River subspecies and therefore coming from Near East (Borghese, 2012). Even though the origins are not yet clear, it is possible to see that the buffalo have adapted to their local environments: the Carpathian and Transylvanian types have hard hooves for moving over stones and have a thick winter coat. Wherever the buffalo live, this Riverine type loves to swim.

Various traditional products were made with their milk, meat and skins. Their muscle power was used on the farm as traction. Buffalo were valued for their frugality, longevity and triple-use.

The negative side of the buffalo is, perhaps, part of the key to its downfall: the cows often only let down their milk for one person – usually the man of the family - they can also be aggressive and are extremely wilful and stubborn. These factors, along with the increased use in tractors and the promotion of high-yield cows led to the buffalo being replaced. Numbers in the last 20 years have decreased from tens of thousands down to, in some countries; too few to make breeding viable without import of new stock (SAVE, 2011).

The buffalo population in Romania was more than 200 000 head in 1996 (Borghese, 2005). Actually it is about 25,000 head, located particularly in Transylvania, classified as Mediterranean Carpathian breed. The SAVE Foundation (SAVE, 2011) organized an International Workshop on Conservation of Autochthonous Buffalo on 6-7 May 2011 in Sighisoara (Romania), as the real risk for Carpathian buffalo is the extinction. The conservation strategy is based only on subsidies, so the population is rapidly decreasing as family farmers don't need more animals for draught and carry as in the past.

The average milk production, but only in few recorded animals, in 2008 was 1,800 kg per lactation (274 days) with some champion producing until 3290 kg per lactation (Vidu, 2010) with fat percentage moving from 5.2 to 6.2% and protein from 3.5 to 3.9%. The animal recording is at good level (669 recorded animals in 2009) and artificial insemination too with 2041 effected A.I. in 2008 (Vidu, 2010). The mean age at the first calving is 36 months, calving interval is 485 days.

Buffaloes are still used today on small private farms for draught and the goal of the selection process is to create a dual-purpose type of animal (milk and meat), realizing good daily gains (600-800 g), in order to slaughter the males at 22 months with 460 kg of live weight. At present the calves are also fattened to be slaughtered at four months (100 kg of live weight).

The animals are housed and tied during the winter due to the unfavourable weather conditions and fed with hay, bran, concentrates, silage, grazing on pasture in the warm season (figure17, 18, 19).

As Romania buffaloes can have these performances, but only if correctly managed, they need soon a project to increase rapidly the milk production capacity in all the population, even applying artificial insemination with Italian semen, to create a milk-cheese market and justify a buffalo economy in the country.

Subsidies are not a long-term, sustainable solution for conservation of the species, one or two animals for family. Policy changes can lead to immediate decrease in numbers as subsidies are cut or the focus of them merely changes.

Connecting with nature conservation in protected areas by grazing provides a cost-effective eco-management system whereby buffalo can obtain a monetary value without requiring a commercial activity. This, in turn, can be coupled with agri-tourism activities, use within extensive production systems and linked to local traditions and ethnic minorities.

In many of the countries concerned, availability of land and land ownership has been negatively

affected by historical processes. Land has changed hands, been collectivised or, in some places, national borders have changed. Often it is impossible to find out who really owns a piece of land, this is compounded by the fact that many traditional farms are so small-scale that, to buy a land parcel large enough for a commercially viable buffalo herd would mean tracking down many previous owners and their relations in order to negotiate a purchase (SAVE, 2011).

Markets for buffalo products (dairy products and meat) exist but could be improved upon. Common dairy products are yogurt, butter, soft cheese and typical cheese as Vladeasa and Braila (Borghese, 2005).

Figure 17, 18, 19. Buffaloes on Transylvania pastures in Meschendorf (Borghese photo 2011)

3. BULGARIA

The mechanization entered in the agriculture and led to a decrease in the buffalo population. For this reason it was necessary to change the genetics of the native buffalo from draft type to milk type. 20 pregnant buffalo cows and 10 bulls from the Indian Murrah breed from India, 50 buffalo cows and 4 bulls from Nili Ravi from Pakistan were imported in Bulgaria in 1962 and 1974 respectively. This activity was effected systematically under the scientific management of the Buffalo Research Institute in Shumen and the National Animal Selection Centre (Alexiev, 1998). This was the beginning of creating a new milk breed, the Bulgarian Murrah (figure 20,21) with genetic potential 2000 kg milk yield, 7.5% fat content and 550-600 kg body weight of adult buffalo cows.

For the purpose of optimizing genetic improvement of the buffalo population in respect of milk ability, a selection program based on genetic level of the population and on the artificial insemination was developed by Alexiev (1979) and improved by Peeva (2000). In the program an estimation of the most important traits was made, as well as of fixed and variable parameters. A model, including four pathways of genetic transmission and inbreeding depression was developed (Alexiev et al., 1991). According to the programs of the authors an annual genetic gain of 1.06% and 1, 89% for milk yield was realized, respectively.

The number of buffaloes in Bulgaria at 01.11.2008 was 8968, including 5153 dairy buffaloes (Peeva, 2009).

On the private farms, where the population is concentrated the reduction is 36,0%, whereas on the state and cooperative farms this reduction is 98,8% compare to 1990. The interest in buffaloes increased during the last years which led to building buffalo farms with capacity from 10 to 100 dairy buffalo cows. From the total number of the buffaloes, 43,8 % are rearing in farms with capacity up to 20 buffaloes and 56,3% with more than 20 (Peeva, 2009).

As a result of the crossing up to now the buffalo population is more than 80 % of Bulgarian Murrah breed. As the results of the crossing of Bulgarian Local buffalo with Murrah breed during the last decades came substantial transformations on its type and body

conformation. The cows from Bulgarian Murrah breed are characterize as animals with deep and wide thorax and body compact in comparison with Bulgarian buffalo cows.

Another evidence of the presence of genetic capacity for high milk newly population is the fact that many buffalo cows have a milk yield above 2500-3000 kg and some of them – more than 4500 kg.

The champion of the population is crossbred F2 from which is obtain 5349 kg with 6,64 % fat for 305 days (Peeva, 2009).

During 2009 from Italy was imported semen of Mediterranean buffaloes to cross with Bulgarian Murrah. The main purpose of the crossing is to increase genetic diversity in buffalo population, to decrease inbreeding and improve the body conformation of the animals.

The mean values of the lifetime traits in the Bulgarian Murrah are as follow: productive life is 1451.18, which is equal to 3 years and 4 months (Ilieva and Peeva, 2007), longevity is 2646 days (7 year, 3 months) as for culled cows at first, second and third lactation is respectively 1254, 1708, 2435 days (Peeva and Ilieva, 2007); lifetime milk yield – 5851 kg; milk yield per day of life time – 1.97 kg; lifetime lactation period – 858 days; milk yield per day of lactation period – 6.64 kg; lifetime lactations number – 3.67; lifetime calving interval – 1288 days; milk yield per day of productive life – 4.43 kg (Peeva, 2009).

The percentage of culled cows for low productivity is 19%, including buffalo cows having milk yield below 200 kg per lactation of 120 days; the prolapses takes 11% of the total culled cows, including vaginal and uterine prolapses; the proportion of culled cows with short lactation is 7%; the culled cows for old age (over 8 lactations) are 9% of total: this shows that the longevity of buffaloes is longer than in cattle (Peeva and Ilieva, 2007).

Main source for meat are male calves. Investigations regarding the fattening abilities of buffalo calves show considerable differences by comparison with beef calves (Dimov and Peeva, 1994). The average daily gain of buffalo calves is between 650 and 1083 g.

The most effective slaughter body weight is 400 kg (Dimov and Peeva, 1994).

The buffalo has lower dressing percentage compare to cattle. For suckling calves it is about 56 %; to 4 months of age it is 59.4 %; from 6 to 12 months it is 45 %; from 12 to 18 months it is 47 % and over 24 months 45.3 % (Peeva, 2009).

The average age at first calving is within the range from 32 to 40 months on different farms in the country and different breeds (Peeva, 2000).

The calving interval range from 436 to 505 days according breed, nutrition and management of the farms (Peeva, 2000).

Buffaloes were raised on the State farms, kept tied in closed sheds, machine milked and fed maize silage, alfalfa or grass hay, straw and concentrates.

The animals were manage in separate groups according to physiological conditions: suckling calves, females four to twelve months, heifers, pregnant heifers, dry cows and milking cows.

After the changes in the political and social-economic system in 1989, buffaloes were transferred to the new private farms, where scientific and genetic activities were limited and the animal numbers have drastically declined.

Actually, there are only 9 200 head, of which 5 880 are cows of Bulgarian Murrah in Bulgaria (Borghese, 2011). These animals are submitted for milk recording and to artificial insemination.

Milk recording, selection, artificial insemination and progeny testing are coordinated by the Buffalo Research Institute in Shumen.

Products: White brine cheese, typical yoghurt, salami, sausages, Pastarma. The most of the market is link to the typical buffalo yogurt, very appreciated and to meat by products.

Figure 20. Bulgarian Murrah bull (Alexiev photo, 1998).

Figure 21. Bulgarian Murrah herd (Alexiev photo, 1998).

4. GERMANY

In Germany there are now 2111 buffaloes, in 14 different Regions, but particularly in Sachsen (434), in Baden-Wurttemberg (389) and in Brandenburg (287) (Thiele, 2009, Borghese, 2010). The Germany is an example of adaptation capacity of buffaloes to cold climates; they

can stay on the snow without problem (figure 22). Normally the animals are managed in the stables during winter and on the pasture during spring and summer (figure 23). The population started with 625 head imported by Italy and Bulgaria in 2001, showing now typical characteristics of Mediterranean or European breed, much more similar to Balkan type (figure 24, 25) than to Bulgarian Murrah. The population had a quick increasing linked to a rich market of high quality products, coming from milk and meat processing as mozzarella and other cheeses, cream, yogurt, sausages, meat boxes, and also beauty products (figure 26).
Germany is another example of a new and rich market, invented by the buffalo farmers.

All buffalos are recorded in the German livestock controlling system.

According the report related to the 2 biggest buffalo herds of Sachsen (Saxony), Dr. Golze reported the level for traits of fertility, milk and growth performance relating to the years 2004/2005 (Guglielmetti, 2007):

Weight at birth was found to be 44.7 kg for male buffalo calves and 39.5 kg for female buffalo calves respectively. Weight at 3 months was 147.0 kg for male calves and 132.4 kg for female calves. Weight at 9 months was 351.2 kg for male calves and 305.7 kg for female calves.

Males were used for breeding from the age of two years (Guglielmetti, 2007).

Figure 22. Mediterranean buffalo on the snow in Sachsen (Guglielmetti photo 2007).

Figure 23. Buffalo on the pasture in Sachsen (Guglielmetti photo 2007).

Figure 24. Mediterranean buffalo young bull, Chursdorf, Germany, *(Manfred Thiele photo 2008).*

Figure 25. Mediterranean buffalo cow, Chursdorf, *Germany, (Manfred Thiele photo 2008).*

Buffalo heifers were first mated at the age of 18 to 24 months. Age at first calving was 35 months on average. Calving interval was on average 633.5 days. The buffalo bulls were commonly slaughtered at a weight between 540 and 760 kg (Guglielmetti, 2007).

Regarding milk performance Dr. Golze reported (Guglielmetti, 2007) that in the Chursdorf herd over a 305-day lactation period, milk yield was on average 2232 kg in the first lactation and 2577 kg in the second lactation. Fat yield was 193.7 kg in the first lactation and

237.7 kg in the second lactation. Protein yield was on average 101.0 kg and 123.7 kg for the first and second lactation respectively. There was found a big variation for these traits.

A recent study (Guglielmetti and Golze, 2009), conducted by the Saxon Regional Office for Environment, Agriculture and Geology, required male and female young buffalos to be slaughtered at an age of 647 days (561 to 757 days, n = 12). Weight at slaughter was 549 kg on average. The dressing percentage was 56.7%, whereas the weight of the two halves was 307.1 kg. The percentage of valuable parts was found to be 62.5% on average. The meat taken off the M. longissimus dorsi contained 21.4% raw protein, 2.5% raw fat, 75.0% water and 1.1% ash. At 48 hours after slaughter pH was at 5.5. The drip loss was 3.5%, loss after grilling 32.6% and loss after cooking 47.3%. Shrinkage on chilling was 3.6% after 14 days and 4.2% after 21 days. According to Minolta CR300 the meat colour was 33.3. Tenderness was measured: 5.2 kg at 48 hours post mortem, 3.4 kg after 14 days and 2.8 kg after 21 days.

Figure 26. Typical buffalo products from Germany.

5. MACEDONIA

The buffalo farms in Macedonia are very few, 4 or 5 at all perhaps, and the total population is very reduced, probably 175 animals (SAVE, 2011), but nobody from many people knows exactly the reality; there is a farm in Debreshte village (near Ropotovo), with some local dairy cows and 12 buffaloes of Mediterranean breed, but small and compact, that were bred on natural pasture (figure 27, 28). The first problem of the farmer is that they have no male and very high consanguinity. The proposed solution is the introduction of artificial insemination by Italian semen to increase the milk production, actually very low, and to introduce different and better genetic basis (Borghese, 2010).

In Mojanci village (near Kocani), there is a family farm with 8 buffaloes in the farmyard close their house, of the same Mediterranean breed (figure 29), but the animals were bigger than in the previous farm. The farmer produces simple cheese that is sold in local market (figure 30).

The reality is that a programme to save and develop buffaloes in Macedonia is a priority to maintain biodiversity, to conserve buffalo genetic that was introduced 5 centuries ago with

Turkish invasion, to develop animal farms and typical products for local market and as a basis for tourist economy. The project presented by the Animal Science Institute to the Agricultural Ministry, will be carried out with the cooperation of Italy (Borghese, 2011).

Figure 27. Mediterranean Macedonia breed, Ropotovo, Macedonia. *(Borghese photo, 2008).*

Figure 28. Buffaloes on pasture, Ropotovo, Macedonia. *(Borghese photo, 2008).*

Figure 29. Family management in Mojanci village, Kocani, Macedonia. *(Borghese photo, 2008).*

Figure 30. Simple cheese in Mojanci village, Kocani, Macedonia. *(Borghese photo, 2008).*

6. UNITED KINGDOM

There are a maximum of 2500 breeding females in the UK and probably a maximum of 1200 milking animals and maybe less (Borghese, 2010).

As for milk yields, the average is 1500 kg per year. This was due to poor quality buffalo imported from Romania and also some mis-information through ignorance of the nutrition of buffalo.

An imported way of bulls too has been from the North of Romania. The best animals are without doubt those that show signs of Bulgarian Murrah ancestry, and indeed the sires of over half of foundation animals were Bulgarian (from AI).

Lactation length is about 300 days in the best (with perseverance) but considerably less in some, particularly in the first lactation. Calving interval is usually a bit over 365 days (Wood, 2009).

7. GREECE

In Greece, due to the rapidly changing socio-economic conditions, including the mechanisation of the agricultural sector and the substitution of buffalo milk by milk produced by imported dairy cattle, the number of buffaloes has declined dramatically over the last decades. As a result, from the 75 000 animals counted at the end of the 50s, today only few head remain. There are 2503 buffaloes in Greece (Ligda, 2009). Currently the population has increased, reaching 3137 animals by the end of 2010 (SAVE, 2011) with 28 herds distributed in 21 localities in western, central and northern Greece; most animals are found in the area of Lake Kerkini National Park where they are considered an integral part of the protected area. All herds are monitored by the Centre for Livestock Genetic Improvement (CLGI) in the framework for the conservation of genetic resources in the livestock breeding sector run by the Ministry of Rural Development and Food. Herd books and records are kept by CLGI in collaboration with the Association of Buffalo Breeders of Greece (Kazoglou et al., 2011).

Lactation length varies from 210 to 280 days with an average lactation milk of 700-1000 kg while the age at first calving is 36-48 months (Borghese, 2010).

The age at slaughter for young stock is 15-17 months and the weight at slaughter is 350-400 kg.

The cows are milked twice a day at the farm by hand.

Buffaloes are not used for draught, but only for milk and meat production. The dairy products obtained from buffaloes are yogurt, white cheese in brain, butter, kaimaki and cream.

Each farmer has his own bulls available for natural service in fields and used in proportion 1 to 8-15 cows. Artificial insemination is not applied. Efforts for buffalo production are made by researchers of Greek Focal Point for the Preservation and Conservation of the Animal Genetic Resources, at the Aristotle University of Thessaloniki, with the support of the Ministry of Agriculture to rehabilitate buffalo production and to let buffalo farming, at present under protection, to become an economic viable activity. Really the buffalo market is much reduced.

7. SERBIA

There are 1200 buffaloes in Serbia (SAVE, 2011) of Mediterranean breed, Balkan type (figure 31, 32). They are kept in extensive low input production system (figure 31, 32). The number of buffaloes and trend of population is stable, in the last ten years. Activity on

conservation is supported by the Ministry of Agriculture, through the subsidies and program for crossbreeding in pure breed (Stojanovic, 2011).

Buffaloes could have an important role for high quality food (production of health and safety food, organic production, particularly appreciated are local fresh cheeses, figure 33) , ecological production and integral development of rural areas, anticipating combination of agriculture and rural tourism (Stojanovic, 2011).

Figure 31. Mediterranean Serbian cow. (Srdjan Stojanovic photo, 2011)

Figure 32. Mediterranean Serbian cow (Srdjan Stojanovic photo, 2011).

Figure 33. Fresh cheese. (Srdjan Stojanovic photo, 2011).

8. ALBANIA

Albanian buffalo is an authochtonous breed, classified in the group of Mediterranean breed.

The mantel is black or dark grey and rarely with white spots. Horns arched back and side inward bent. Buffalo population is 321 Albania head (SAVE, 2011). They has been used mainly as draught power; however Albanian farmers and consumers have been interested for their milk and meat products: milk yield is around 450-600 kg in the first lactation going up to 850- 980 kg in the third one; its fat and protein content are respectively 3-10.2% and 5.3-6.8% (Papa and Kume, 2011). Fertility rate is round 80-85% and days open 120-150 days.

During 2010 more than 21 farmers, in four regions of Albania, have received subsidies for buffaloes: as result the size of buffalo population is increasing; the breeding nucleus in four farms has been established. Until now 13 male lines are selected. Nevertheless there is the need to control inbreeding level and provide breeders for an exchange of the breeding stock (Papa and Kume).

9. UKRAINE

There are 115 buffaloes in Ukraine (SAVE, 2011). The percent of crossbreds with Murrah is very high. The Mediterranean Carpathian breed is present too. Some animals were imported by Armenia on 1984. The Ukrainian buffalo population has the real risk of extinction.

In 2004 private initiatives collected rare and unique animals for tourist attraction: one part stays spread over Western Ukraine and the other is located in Kiev region (Jacobi, 2011).

The "Saving of Agro-biodiversity of Carpathian mountains" is working to stop decline of buffalo population, to create nucleus herd farms, to support contact among the owners, to

regulate problem of inbreeding, to search private people who are ready to create small buffalo farms and village communities working in cooperation production (Jacobi, 2011).

As buffalo cannot survive as zoo animal only for tourist attraction, but need to become milk and meat producer.

10. HUNGARY

A small but tenacious population is living in Hungary for many years (Cockrill, 1974). They were introduced by the Turks in 16th century and the population is named Carpathian or Mediterranean Hungarian Breed (figure 34, 35). There has occurred a decline of population due to loss in economic value of working buffaloes (Karpati, 1997). According SAVE (2011) there is 200 buffalo head in Hungary. According direct information by the Ministry of Agriculture and Rural Development, there are 2000 buffaloes, most of them living in National Parks, as gene reserves.

Now, according a new project, some new modern farm are going to be created, introducing Mediterranean Italian head of high genetic value from Italy, with the purpose to originate a market of milk and meat quality products.

Figure 34, 35. Mediterranean Hungarian buffalo.

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