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Breeding goats for organic production in Germany

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Introduction

With only 120,000 females (year 2000), goat keeping is a niche activity in animal husbandry in Germany. Most of the goats (about 90%) are kept on part-time farms. The main reasons they are kept are as a hobby, for milk production and for landscape management; in many cases it is a non-profit oriented activity. There are estimates (no official statistics exist) that 20,000 goats are milked and 10,000 are used in landscape management to avoid shrub succession on protected biotopes. In the year 2000 10% of the goats (12,000) were kept on organic farms but not all for economic reasons.[1]

Because the dairy breeds in Germany (White and Brown German Alpine) are selected under intensive keeping conditions, breeding under the restrictions of organic farming is necessary to get adopted and high yielding flocks. This is even more true in the case of harsh environmental conditions in landscape management. The German breeds are not suitable for the needs while grazing on marginal biotopes. This paper will show some results of:

- a ten-year breeding programme for more milk ingredients, fat and protein, in a flock of 30 mother goats on an organic farm and
- the breeding programme of the "Witzenhäuser Landschaftspflegeziege WLZ" for the new purposes of landscape management.

[1] This is the highest proportion of an animal species on organic farms. In 2000 only 0.5 to 1.5% of the total cattle, pigs and hens were kept on organic farms.

The history of goat breeding in Germany

Goat keeping has a long tradition in Germany. They were kept by poor and landless people, rarely by land owners. Goats were the "poor people's cow", easy to keep, cheap to purchase, quick to reproduce, and they delivered milk and meat in home consumption quantities (Benecke, 1994). Breeding was based on the knowledge and capabilities of the goat owners, inbreeding the method of reproduction (Abel, 1978). Therefore many different local breeds appeared. The animals were small and low yielding but very tough in harsh environments and keeping conditions. In the 18th century, with the devastation of the woodlands, goat browsing in the forests was prohibited under penalty of severe punishment and a hefty fine. Goats left the forests and pastures and went into the stables. At the end of the 19th century about three million goats were kept in small herds of between one to five animals in small stables in the backyards of people's houses (Gall, 1982). Most of the goats were kept by workers in the villages and cities but also by people living in remote areas. Large numbers of goats could be found in industrial areas ((e.g. the Ruhr), mining areas (e.g. Salzgitter/Peine, Harz) and big cities (e.g. Berlin, Hamburg, Munich) (Comberg, 1984)).

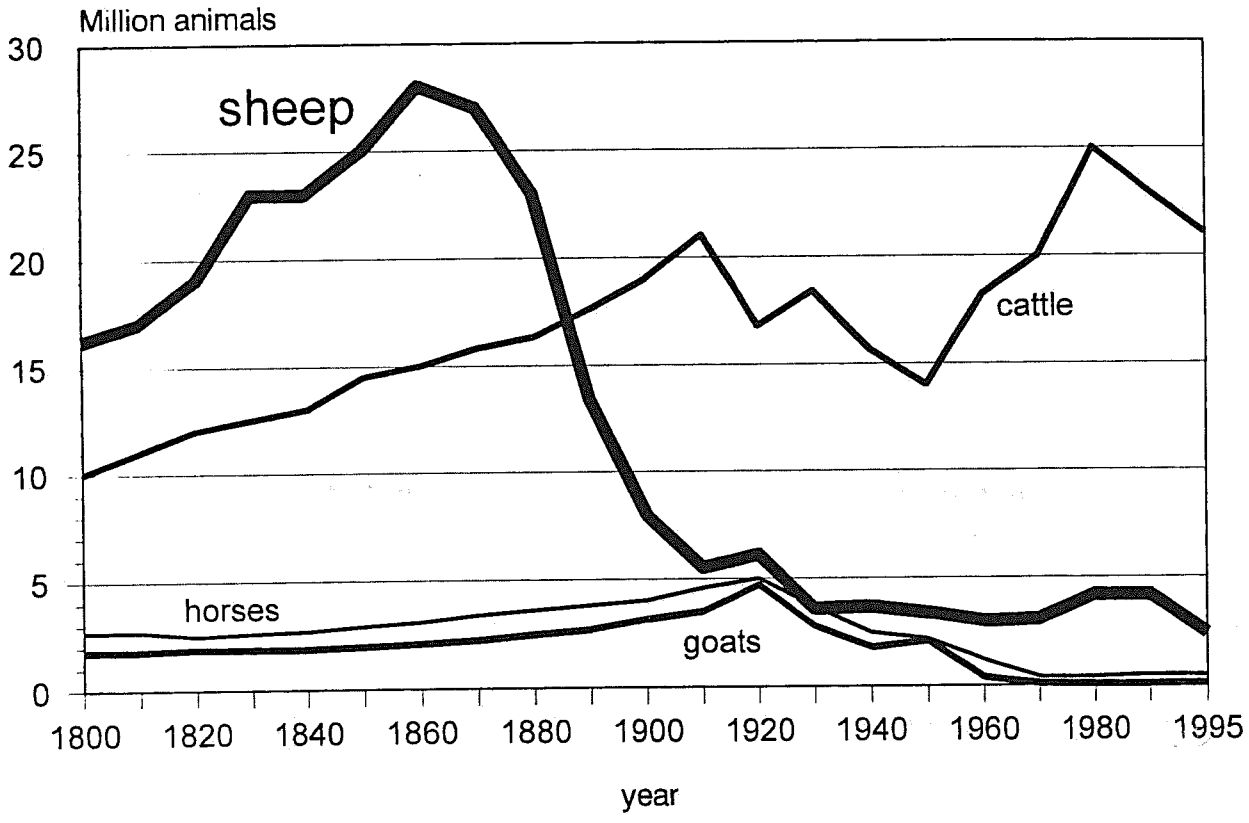


Figure 1: The development of animal keeping in Germany in the last 200 years

Source: Rahmann, 1998

No planned breeding took place until the end of the 19th century. In the year 1884 the first bucks of Saanen and Toggenburger breeds were imported from Switzerland to improve the milk yield of the local breeds (Dettweiler, 1902). Since 1902 breeding bucks have required breeding certification by law. Every village had to keep a buck for mating. The first private breeding associations were established in Hesse and in some cities in the Ruhr. After the First World War five million goats were kept in Germany. After that peak the numbers decreased rapidly and reached their lowest level of only 36,000 animals in 1977 (Figure 1). It was decided that goats would be excluded from the statistical farm livestock census (Gall, 1982). Because there are no official statistics and no goat census has been conducted since 1977, only estimates of goat numbers are available. Nowadays about 120,000 goats are kept in Germany, most of them in Bavaria (27%) and Baden-Wuerttemberg (26%) (Rahmann, 2000).

Two native dairy breeds are of importance: the White German Alpine and the Brown German Alpine (Weiße Deutsche Edelziege and Braune Deutsche Edelziege). The former make up 30% and the latter 65% of the German goat population, while 5% come from 12 other breeds.[2] The reason that only two dairy goat breeds exist today is that in 1928 the "Reichsverband Deutscher Ziegenzuchtvereinigungen"(goat breeding association) decided to combine all white and all coloured breeds into a single breed of each. In Germany the milk yield of well-managed dairy goat herds is about 1,000 kg per year in conventional farming systems (Table 1) and 700 kg per year in organic farming systems. Top yields of individual animals can reach 1,500 kg and more per year. The fat and protein content is an important factor for cheese production. In conventional farming the production of 50 to 60 kg fat + protein per goat per year is common with the high yielding dairy goats (Lange, 1999). (see also Table 2)

Table 1: Comparison of high yielding dairy sheep, dairy goats and dairy cows (figures from conventional farming)

	Dairy sheep (East Frisian Milk Sheep)	Dairy goat (White German Alpine)	Dairy cow (Holstein Frisian)
liveweight in kg	80	60	650
Metabolic liveweight $kg^{0,75}$	27	22	129
Fodder intake in kg dry matter/day	2.7	3.0	18.0
Lactation yield in kg	600	1,000	7,000
Fodder intake in $g/kg^{0,75}$	100	139	140
Lactation yield in $kg/kg^{0,75}$	22	46	54
Fat yield in $kg/kg^{0,75}$	1.3	1.7	2.2
Protein yield in $kg/kg^{0,75}$	1.1	1.3	1.8

Source: Bellof & Weppert (1996); Heindl (1997)

[2] During the last few years the South African Boer Goat has gained some importance in Germany for meat production.

Table 2: Contents of cow, sheep and goat milk (dairy breeds)

	Cow milk	Sheep milk	Goat milk
Water	87.7%	83.2%	88.0%
Fat	4.0%	6.2%	3.5%
Protein	3.4%	5.3%	3.0%
Lactose	4.8%	4.4%	4.7%
Minerals	0.7%	0.9%	0.8%

Source: Lange (1999)

The flock size of a full-time dairy goat farm is not more than about 50 lactating goats plus youngstock.[3] Dairy goat farms are established under conditions of shortage of high productive land and lack of capital. Therefore goats are still the "poor people's cow". Income is generated by high levels of processing and direct marketing of goat cheese. About 80 labour hours per year are needed for one dairy goat: 30 hours for keeping and milking, 30 hours for processing and 20 hours for marketing. In Germany goat cheese is a niche product with a very limited market potential (one goat farmer per 100,000 inhabitants is enough to satisfy market demand). About 20 EURO are paid on the farming markets for one kg soft cheese and 25 for hard cheese. With established dairy goat farming 7 to 8 EURO per labour hour is the usual return.

Breeding in organic dairy goat farming

The high yielding dairy goat breeds in Germany are kept on organic farms as well. The improvement of these breeds is focused on the fat and protein content of the milk. Because of the regulations a specific type of breeding in organic farming is needed. Selected breeding goats from conventional farms are tested under conditions which are not comparable with conditions under organic farming regimes. Therefore productivity and fitness is much lower than expected. The restrictive factors influencing the productivity of the animals are as follows: the purchase of animals from non-organic sources, limited concentrate feeding, roughage qualities that greatly fluctuate seasonally and annually, and the prohibition of preventive and allopathic veterinary intervention, in particular endo-parasite control. The breeding strategy respects the needs and health of the animal and takes the keeping conditions into consideration.

An analysis of the development of milk parameters and breeding strategy success was carried out on a full-time organic dairy goat farm in the middle of Germany from 1992 to 1998.[4] The farm has been managed under organic farming rules since 1982 and keeps

[3] Because many goats are kept on part-time farms and for hobby reasons, only four goats are kept per goat keeper (33,844 goat farms with 120,000 goats). It has been estimated that only 100 farmers in Germany keep goats as the main activity at their full-time farm. There are only a few farms where more than 100 dairy goats are kept. The goat density is very low: 0.591 goats per km^2 farmland and 1.957 goats per km^2 pasture. Figures for dairy cows: 30 per km^2 farmland and 100 per km^2 pasture; beef cattle: 62 and 157; pigs: 91 and 301; sheep: 14 and 45 (RAHMANN, 2000).

[4] Professional, well-run organic dairy goats farms are very rare in Germany. Other farms with the same quality of production, long-term experience in organic farming, a controlled breeding strategy and good data recording were not available. This study was and is still the first scientific analysis of breeding success in organic dairy goat farming in Germany.

30 to 35 dairy goats (Brown German Alpine). The farmer is well experienced in management and animal production. The feeding is 30% concentrates (on-farm production of barley, wheat, carrots and peas) and 70% roughage (dry matter) during lactation with considerations of the lactation status. The goats graze on pastures from May to October and in a warm stable in the winter season. No female goat has been bought since 1982. Breeding bucks only are bought every second year. The breeding is focused on increasing the total fat and protein yield per lactation and per life of the goat on the basis of independent milk control results. In addition to the milk control results, the number of twins, fertility and udder conformation are parameters for selection.

Results

In the six-year period from 1992 to 1998 the milk yield of the total dairy goat flock increased by 10% (1.67% per year), the fat yield by 12.5% (2.08% per year) and the protein yield by 16.7% (2.76% per year) (Figure).[5] Not every year is quite so successful. In the year 1994 the goats suffered from cold and wet summer weather. The energy requirement for body maintenance, low quality wet fodder and reluctance to graze intensively are the reasons for low milk, fat and protein yields. In organic farming the long term trend is more important than in conventional farming due to environmental impacts. This could lead to the interpretation that a breeding strategy should focus on protein yield. The close relation between fat and protein yield in relation to fodder quality hinders this. The breeding strategy should give attention to the total yield of both fat and protein.[6]

[5] It is surprising that all figures are positive. There is a slightly positive correlation between protein and fat yield but a negative correlation to milk yield.

[6] For goats the heritability of 50% for fat and protein yield is slightly above the figure for cattle (40%). The heritability of milk yield is 20% for cattle, while goats show a slightly higher heritability here, too (LANGE, 1999). From cows we know that the best selection parameter is the fat content.

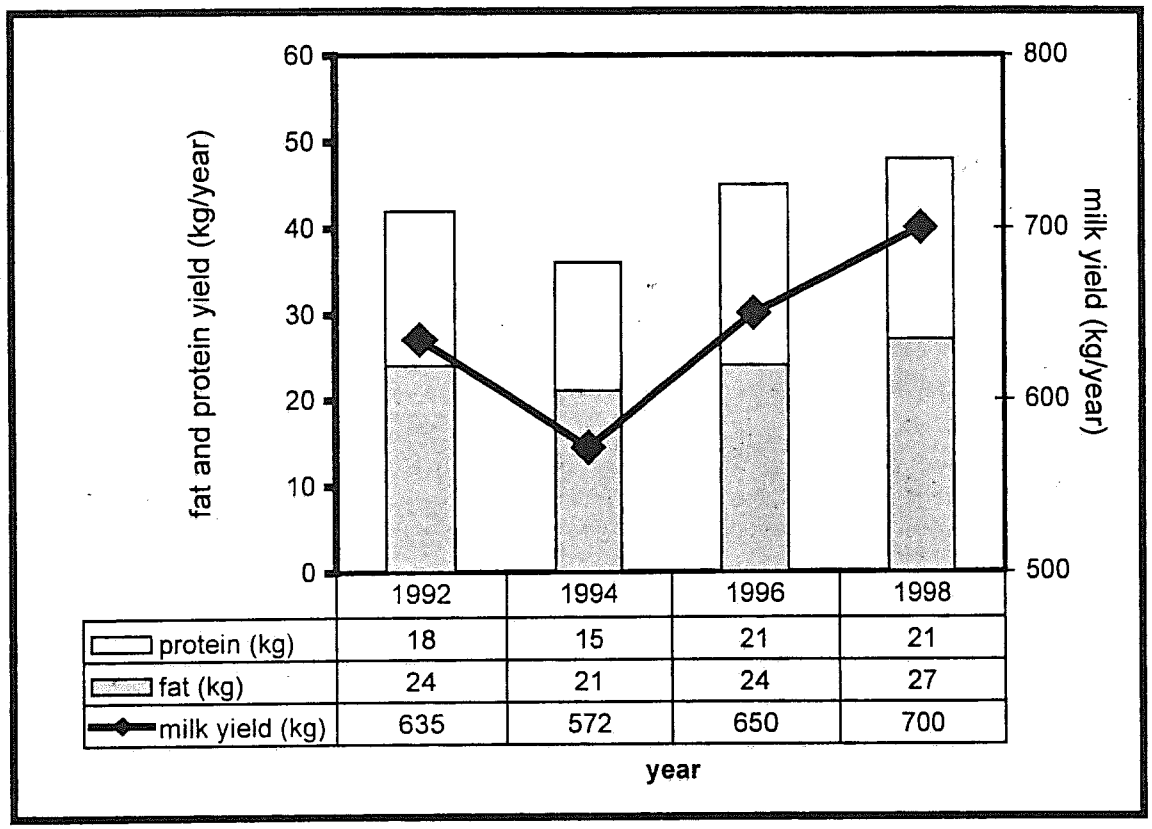


Figure 2: Development of the milk yield and the fat and protein content of the dairy goat flock from 1992 to 1998 (n = 30 to 35)

In addition to the annual impact (Figure 2), the seasonal impact on fat and protein yield is also obvious in Figure . The year 1998 enjoyed good summer weather. Even without milking in November. this year gave the highest quantities of fat and protein. The weather in 1997 was also very good for goat keeping. This can been seen in the good quality of winter roughage in February 1998. The breeding season in autumn 1997 was also successful and had an impact on the fat and protein yields in 1998. An unusually greater number of twins was born (+20%). With twins there is a higher milk, fat and protein yield than with single kids (roughly 10%; Gall, 1982).

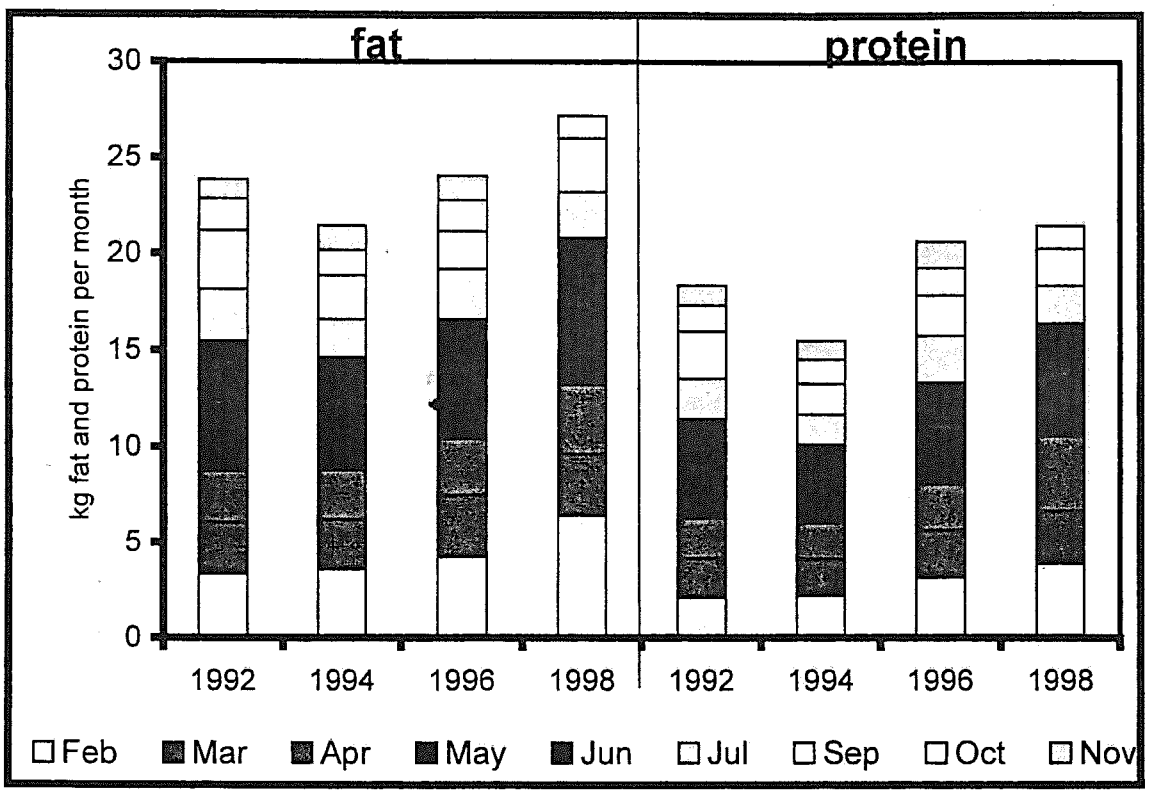
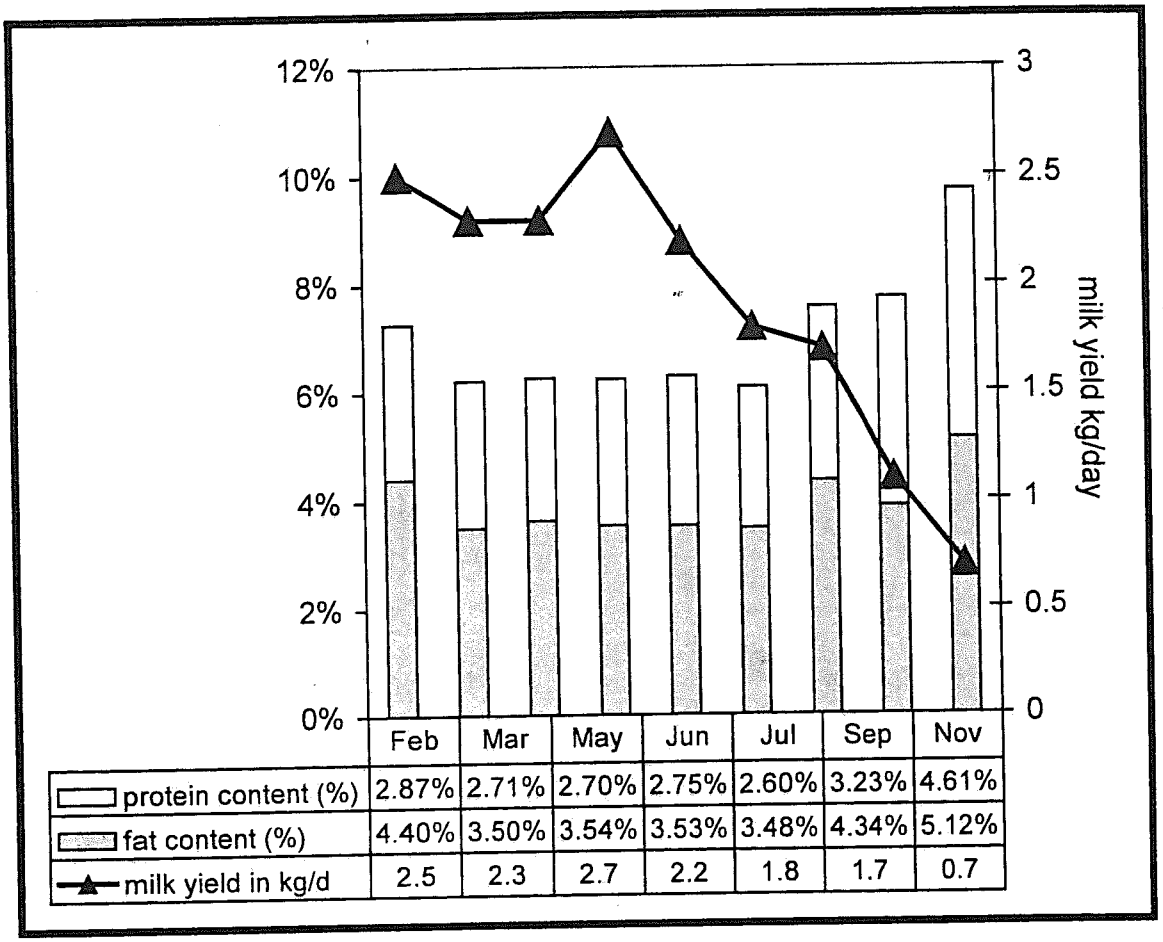


Figure 3: Fat and protein yield by lactation months 1992, 1994, 1996 and 1998 in kg/months (n = 30 to 35)

Breeding should not only look for the annual milk, fat and protein yield but also for even distribution over the lactation period (especially soft cheese production). In Figure 4 it is obvious that the milk content increases with increasing lactation status (thickening effect). Over six months from March to July the fat and protein content in the milk is stable. Breeding should aim for homogeneous distribution over the lactation period. This is also important for the health of the animal.



	Feb	Mar	May	Jun	Jul	Sep	Nov
protein content (%)	2.87%	2.71%	2.70%	2.75%	2.60%	3.23%	4.61%
fat content (%)	4.40%	3.50%	3.54%	3.53%	3.48%	4.34%	5.12%
milk yield in kg/d	2.5	2.3	2.7	2.2	1.8	1.7	0.7

Figure 4: Impact of lactation status on milk yield and fat and protein content (1998; n = 33)

The breeding strategy should take into consideration the fact that the milk, fat and protein yield depends on the lactation number. The second lactation year seems to be the best in organic goat flocks (Figure). But the yield will be lower in the next lactations. The breeding strategy should select young stock from older mothers, which can be compared after several years of lactation. Only these production figures give reliable data about the individual potential of the flock. If data from several years are not available, remontation stock should only be selected from mothers in the fourth or fifth lactation.

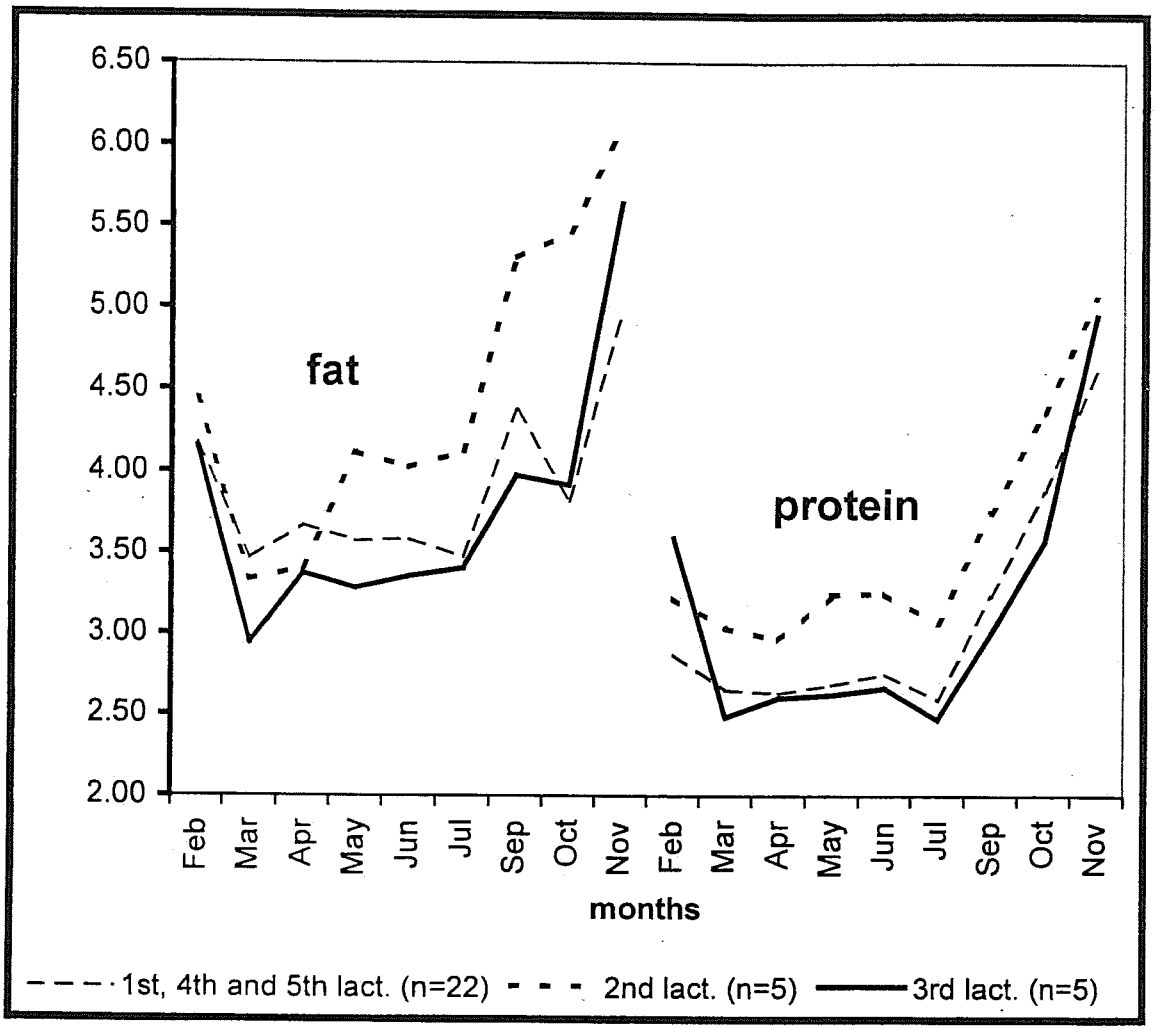


Figure 5: The impact of the lactation number on fat and protein content (1998). (The "Y" axis is fat and protein content (%))

Breeding of robust goats for landscape management

None of the German goat breeds[7] is suitable for extensive grazing on marginal land (no shelter, no supplementary feeds, low roughage quality on the biotope). All German breeds suffer under harsh conditions. In order to develop a robust alternative breed which can cope with extensive conditions, the breeding programme for the "*Witzenhäuser Landschaftspflegeziege*" was set up (Rahmann & Tawfik, 1995)[8].

[7] Goats have an advantage in prevention of shrub invasions on protected biotopes. Up to 50 percent of a goats intake can originate from eating shrubs and bushes. Shrubs and leafs are excellent fodder for goats. This is not considered in the regulations for organic farming in Germany. The pastures in Germany are not acceptable from point of view of animal welfare. Steep, stony and shrub invaded fallow pastures are the best environment for goats.

[8] In Germany, this is the first breeding programme for new functions in animal husbandry since the Second World War. In German agriculture the pure breed strategies are dominant. By selecting from the pure breed populations it is hoped that new functions or keeping conditions might be achieved. From organic farming we know that that is difficult or impossible. The

The aim was to breed a new species of goat which is optimally adapted to the conditions of marginal areas - such as protected calcareous grassland - by crossing the German Alpine goat, the Boer goat and the Cashmere goat (Figure 6).

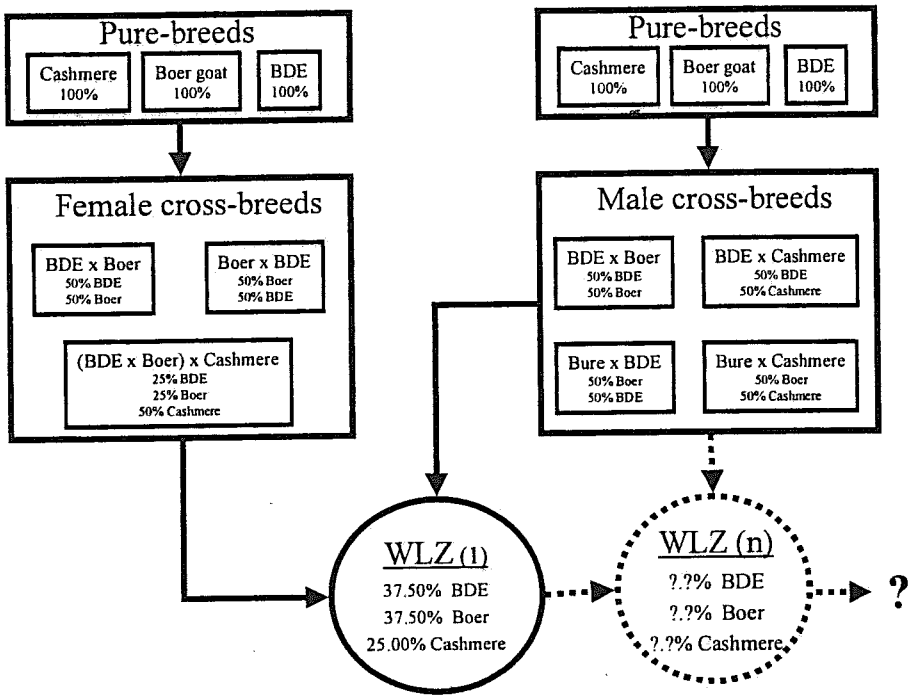


Figure 6: Breeding programme of the "Witzenhäuser Landschaftspflegeziege"

Source: Rahmann & Tawfik (1995)

In general, existing or newly developed husbandry systems have to be adopted to the needs of the conservation site, to the livestock used and to the animals' keeper so that the resulting product satisfies consumer expectations. In Germany goats are mostly known as a dairy animal, and goat meat is often neglected by the consumers. A sizeable amount of kid meat can be sold only at Easter. Thus, there is great need for awareness-raising around the quality and taste of goat meat. This means that constant investigations into carcass and meat quality are necessary. The advantages of good meat quality and quantity cannot compensate the disadvantages of extensive keeping in the climate of LFAs in Germany when the meat cannot be sold for a high price.

The best weight of goat kids for selling is 12 to 25 kg liveweight with a carcass weight of 6 to 14 kg (52-57% of liveweight). The weight of 20 kg was achieved by kids of the high yielding German goat breeds BDE and WDE at an age of 2.5 to 3 months, the meat breed Boer goat at 2 to 2.5 months. The kids are supplement fed and suckled. The best selling time is Easter when there are high prices and relatively high demand. The kids cannot be slaughtered when the mothers of milk breeds are not milked (mastitis problems), so suckling during the summer season is necessary. When the kids are sold

keeping of high yielding animal breeds (e. g. hybrid hens, turkeys, Holstein Frisian, Piétrain pigs) is like "using a Ferrari off-road".

in autumn after biotope grazing they are too big to sell for a high price. Boer goats as a meat breed have been seen as a solution to the constraints of biotope grazing. The kids grow much faster than the milk breeds and have an excellent carcass in quantity and quality. The problem is that this breed is not tolerant to harsh conditions during biotope grazing and winter time. Low yielding breeds (e.g. Cashmere) traditionally do not exist in Germany but are important for biotope grazing because they are climatically more tolerant than all German breeds. The disadvantage is in marketing. They have very low growth rates (below 100 g/day) (see Figure 7) and the kidney fat and subcutaneous fat are immense. They are not preferable as meat (Rahmann, 1998).

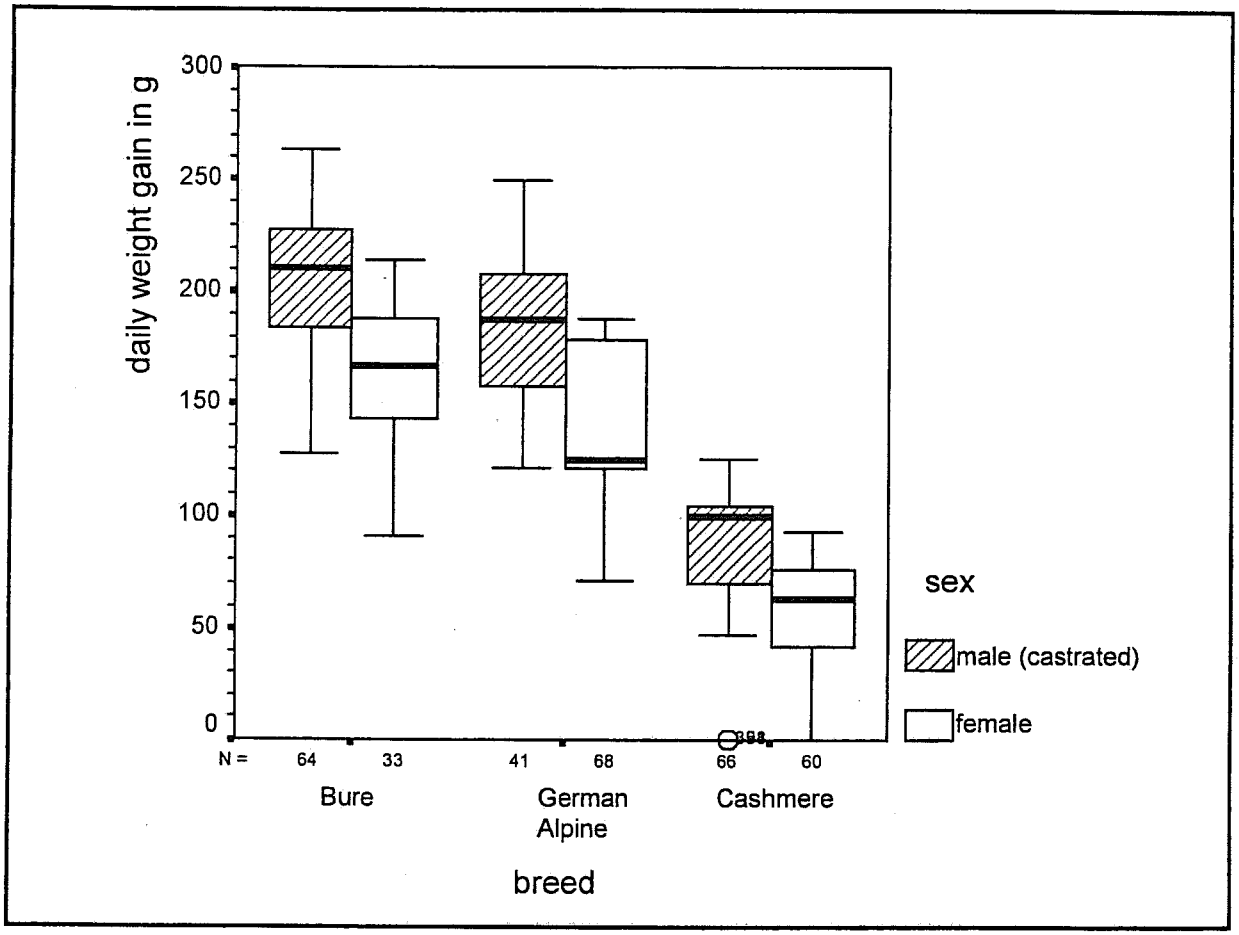


Figure 7: Growth of kids of different breeds under marginal conditions

Source: Rahmann, 1998

Goats generally have a lower weight gain than sheep. Secondly, the quality, distribution and concentration of fat are different to lamb. The intramuscular fat is very low and hardly exists at all during biotope grazing. Kidney fat content is high and smells after a second warming up. Thirdly, the meat is not preferred culturally and many consumers will not eat the meat.

The quantity of meat produced during biotope grazing is less important than for lamb, as direct marketing is the major way of selling. Small carcasses are preferred. When Germans buy goat kid meat they do it for special occasions, like Easter, and they prefer not to store it (freezing). Only some slaughterhouses slaughter goats and they are located in towns with many Muslim or Greek consumers (Berlin, Ruhr, Munich, Hamburg). The transport of goats to these markets is not normally done by goat keepers because it is too expensive; instead the animals come from abroad. The wholesaler price for goats is very low because there is no real competition, and traders and suppliers of meat do not like goats because the market is very small.

Table 3: Carcass quality of kids reared under different environmental conditions

	Intensive, female	Intensive, male	Biotope, female	Biotope, male
Dressing percentage:				
ξ mean (%)	48.55	48.39	45.53	48.08
ξ Standard deviation (%)	1.26	1.60	1.73	5.72
High quality parts of carcass:				
ξ Mean (% of carcass)	42.75	44.69	45.00	44.42
ξ Standard deviation	1.84	1.17	1.85	1.01

Source: Haumann (2001)

Goats have a higher percentage of muscles than sheep. Unfortunately the meat is not concentrated in special parts of the body - "high quality parts" like hind legs and back - but spread evenly (Haumann, 2001). Looking at the feeding strategy, intensively fed females had a lower amount of "high quality parts" than extensively fed ones (Table 3). For male kids there was no distinct difference in the amount of "high quality parts" for the two feeding strategies.

References:

Abel, W. (1978): *Geschichte der deutschen Landwirtschaft.* Stuttgart

Augsburger, H., B. Meyer, S. Rahm & H. Geyer (1983): Über den Zellgehalt der Milch von säugenden Gemsfarbigen Gebirgsziegen. *Schweizer Archiv Tierheilkunde* 125, 103-108

Benecke, N. (1994): *Der Mensch und seine Haustiere.* Stuttgart

Comberg, G. (1984): *Die deutsche Tierzucht im 19. und 20. Jahrhundert.* Stuttgart

Dettweiler, F. (1902): Die deutsche Ziege. *Arbeiten der deutschen Landwirtschaftsgesellschaft,* Heft 69, Berlin.

Fahr, R.-D., G. Finn, J. Schulz & G. Lengerken (1998): Beziehungen zwischen Parametern der Eutergesundheit und der Rohmilchqualität bei Ziegen, 6. Tagung über „Schaf- und Ziegenkrankheiten", DVG, Gießen

Freudenreich, P. (1993): Schlachtkörperwert und Fleischqualität von Schafen und Ziegen. *Kulmbacher Reihe* 12, 54-81

Gall, C. (1982): Ziegenzucht. Stuttgart

Haumann, P. (2001): Selektionskriterien für die Leistung unter extensiven Bedingungen am Beispiel der Ziege in der Biotoppflege. Diss., Göttingen

Hessischer Verband für Leistungs- und Qualitätsprüfungen in der Tierzucht e.V. (1998): Jahresbericht 1998, Alsfeld

Lange, S. (1999): Milchleistungsprüfung bei Schafen und Ziegen im ökologischen Landbau. Diplomarbeit, Witzenhausen

Park, Y.W., M. A. Kouassi & K. B. Chin (1991): Moisture, total fat and cholesterol in goat organ and muscle meat. *Journal of Food Science* 56, 1191-1193.

Potchoiba, M. J., C. D. Lu, F. Pinkerton & T. Sahlu (1990): Effects of all-milk diet on weight gain, organ development, carcass characteristics and tissue composition, including fatty acids and cholesterol contents, of growing male goats. *Small Ruminant Research*, 583-592.

Rahmann, G. (1998): Praktische Anleitungen für eine Biotoppflege mit Nutztieren. *Schriftenreihe Angewandter Naturschutz* 14, Lich

Rahmann, G. (2000): Biotoppflege als neue Funktion und Leistung der Tierhaltung. *Agraria* 30, Hamburg

Rahmann, G. and E. S. Tawfik (1995): Zucht einer Landschaftspflegeziege - Programm und Methodik. *Mitteilungsblatt FG Internationale Nutztierzucht und –haltung* 10, Witzenhausen

Schulz, J. (1994): Somatische Zellen in Ziegenmilch, *Tierärztliche Praxis* 22, 438-442, Stuttgart-New York.

Smith, M. and M. Roguinsky (1977): Mastitis and other diseases of the goat's udder, *Vet Med Ass.* 171, 1241-1248.

Striezel, A. (1998): Leitfaden zur Tiergesundheit in ökologisch wirtschaftenden Betrieben. Göppingen

Warmington, B.G. and A. H. Kirton (1990): Genetic and Non-Genetic Influences on Growth and Carcass Traits of Goats. *Small Ruminant Research* 3, 147-165.

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LOUIS BOLK INSTITUUT

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Introduction

Network for Animal Health and Welfare in Organic Agriculture (NAHWOA) is a Concerted Action Project funded by the European Commission. The main aim of the project is to provide a joint platform for research organisations and institutions involved in organic livestock production. The platform allows sharing of information and ideas along with development of new research priorities and the analysis of conventional research methodologies and their suitability to organic livestock research. It is hoped that the project will create a forum for an on-going discussion on animal health and welfare and their interrelationship within the framework of organic livestock production, and will be able to contribute to the development of organic regulations. The Network has 17 member organisations from 13 European countries.

The five thematic workshops planned for the years 2000–2001 are an important part of the project. The fourth one of these was held at the International Conference Centre in Wageningen, Holland, on 24-27 March, 2001. Over 60 delegates, from 13 European countries and from the USA participated in the proceedings, working groups and field visits in spite of the difficulties and cancellations caused by the then on-going foot and mouth disease outbreaks in boht Holland and the UK. The outbreak and its apparent consequences to livestock industry in Europe gave a poignant backgorund to the meeting.

The theme of the 4th NAHWOA Workshop was *"Breeding and feeding for animal health and welfare in organic livestock systems"*. According to most organic certification body standards and the current EU legislation, breeding and feeding are the two cornerstones of health and welfare in organic livestock systems. It is apparent form these proceedings that the concept of "organic breeds" or "organic breeding" is far from clear and that a lot of work needs to be carried out before 2005, when the current EU derogation allowing sourcing of livestock from conventional breeding systems to organic systems runs out. Similarly, the requirement to feed 100% organic feedstuffs from 2004 onwards makes heavy demands on the development of organic rations for monogastric livestock in particular. These proceedings show that a substantial amount of work is already being carried out to satisfy these requirements, and that some encouraging results are already there.

In addition to the thematic papers, these Proceedings also include a paper by Kat Bazeley *et al.*, presented at the third NAHWOA workshop in France in October 2000. Due to an editorial error this paper was left out form the appropriate proceedings. We would like to apologise for this and hope that those who have searched for this reference in the past will now be able to locate it. Also, abstracts of three posters presented both in Wageningen are presented.

Whilst farm visits could not take place during this Workshop as usual, the day dedicated for these visits was utilised by discussing the problematics of dealing with statutory disease control methods in organic livestock production. Approaches to vaccination and disease eradication and the growing concerns in regard to the spread of the bovine spongiform encephalitis (BSE) in Europe were of particular interest. – In the place of the cancelled farm visit to two organic dairy farms plus an organic poultry farm, a video was made at the farms of Dirk Endendijk and Frits Lozeman, both fundamental breeders within the Dutch Frisian herdbookTheir breeding system is described in detail further on in these proceedings, the delegates were able to see a video made on his farm. This video, "Power of the system", is now available both in English and Dutch versions from the Louis Bolk Institutes (address below).

Reading, September 2001

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For further information on the NAHWOA project, please contact the Co-ordinator or visit our Website at http://www.veeru.reading.ac.uk/organic.

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The Network for Animal Health and Welfare in Organic Agriculture would like to than thank Ton Baars and the members of staff of the Louis Bolk for making the Workshop a success. Because of the Foot and Mouth epidemic, it was impossible to invite farmers to the workshop or to visit any farms but we are particularly thankful to Dirk Endendijk and his colleagues who opened up their farms by allowing a video to be made of their dairy bereeding practices.

Many thanks also go to all the speakers and the delegates who participated actively and without whose contributions the Workshop would not have been a "workshop" and such a true exchange of knowledge and experience as it turned out to be.

Part A:

Breeding for animal health and welfare in organic livestock systems