ALP science 2008, No. 523

«FROM PASTURE TO PLATE» HIGHLIGHTS 2004-2007

Activities of Agroscope Liebefeld-Posieux Research Station ALP

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department
of Economic Affairs FDEA
Agroscope Liebefeld-Posieux
Research Station ALP

Contents

ALP science

First edition

Publisher
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Layout
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Publication frequency
Several times yearly at irregular intervals

ISBN 978-3-905667-62-2
ISSN 1660-7856 (online)

«FROM PASTURE TO PLATE»
HIGHLIGHTS 2004-2007

Dear Readers

Already we are looking back on four years of ALP, as well as at a successful 2004-2007 Performance Contract period. The targets set were achieved almost without exception. Much of our feedback shows that ALP is having a growing impact on those in the field, on knowledge communicators and also, increasingly, on nutritional experts and consumers.
In this publication you will find highlights from our activities over the past four years. At the same time we also give you a preview of our new 2008-2011 Performance Contract.

On the first of January 2008 Agroscope Liebefeld-Posieux Research Station ALP and the Swiss National Stud Farm came under joint management. This close collaboration permits the use of synergies, predominantly in the resources sphere, and provides both institutions with opportunities to benefit research and the equine industry.

The start of the new 2008-2011 Performance Contract and affiliation to the National Stud Farm also brought staff changes. On the first of January 2008 Daniel Guidon became the new Research Vice Director of the ALP/Stud Farm Management Unit. Andreas Aeschlimann, the previous Vice Director, has taken over the job of "International Research, Acquisition of Third Party Funding" - an increasingly important area for our institution. We are appointing Christine Grivel Niklaus to the post of second Resources Vice Director of the ALP/Stud Farm Management Unit as of 1st November 2008. On 1 February 2008 Dieter Hess succeeded Daniel Guidon in managing the "Safety and Quality" product.

I hope you enjoy reading on!
Michael Gysi
Director ALP

2004-2007 Performance Contract: Agroscope settled in

Since 2004 the Swiss Federal agricultural research stations have successfully been incorporated into the Agroscope family brand. They have positioned themselves at home and abroad as a recognised institution for the promotion of sustainable, multifunctional agriculture. The relevant guidelines are laid down in the Agriculture Act and formulated in Agricultural Policy Reform Stage Three (AP 07). Together with the 2004-2007 Research Concept of the Federal Department of Agriculture they form the basis of the 2004-2007 Performance Contract for Agroscope, awarded by the Federal Council.

The Performance Contract period bore the stamp of underlying conditions and a changing environment, for example the abolition of milk quotas by 2009, market liberalisation, structural change, changing consumer habits, and also of budget cuts resulting from Relinquishment of Functions Planning (AVP), the Relief Programme (EP03) as well as loan embargos and centralisation of Federal Government resources.

Efficiency boost from merger with ALP

The beginning of the new Performance Contract was accompanied by the merger of the Liebefeld Dairy Research Station (FAM) and Posieux Animal Production Research Station (RAP) to form Agroscope Liebefeld-Posieux. This facilitated the interlinking of research, from animal feedstuffs through production and processing to foods of animal origin. It was also possible to effect savings in the resources area and use these to benefit research.

ALP projects covered important developments in quality, safety, nutrition, health and natural resources. Over 90 % of the goals set in the Performance Contract were achieved. The research, implementation and advisory activities carried out by ALP have helped to ensure that the production of milk, meat and honey is and will remain a strong central pillar of Swiss agriculture.

Milk and meat production

With the success of its research focussing on production systems, feeding strategies, animal health and product quality, ALP was able to supply practical solutions to integrated and organic farming.

Since a great part of Swiss farm land is pastures, issues on grazing were and still are a priority in ruminant research. Various grazing and complementary feeding strategies were investigated for milk production, and low input grazing systems with beef cattle were tested as possible tools for conservation of alpine pastures. In pig research there was an in-depth examination of an alternative outdoor rearing production system. Furthermore, young boar fattening as an alternative to the current practice of piglet castration was evaluated.

Feeding regimes have a significant impact on animal health, thus various issues relating to the prevention of nutritional diseases in animals were also tackled. High-value animal products are crucial for a sustainable agricultural production and hence have been an important part of research efforts at ALP. Detailed investigations were therefore carried out focussing on the influence of feeding regimes or production systems on technological, nutritional and hygienic quality of products.

In milk and meat production, the importance of Swiss pastures has increased.

The pasture - an efficient natural milk production system

The work programme included trials carried out with dairy cattle on "L'Abbaye" organic farm in Sorens. This covered and covers topics such as optimum grazing pressure, processability of milk to cheese and suitable genetics for pasture-based production systems. The effects of energy-rich concentrate supplementation in pasture-based production systems were investigated on the Posieux experimental farm.

Initiation of experimental activity on "L'Abbaye" organic farm in Sorens

"L'Abbaye" organic farm is a property of the canton of Fribourg and is managed by the Agricultural Institute of Grangeneuve (IAG). In 2003 the use of the future organic farm for research purposes by Agroscope Liebefeld-Posieux ALP was established in an agreement between ALP and IAG. In year one the effect of a biological control method (Duddingtonia flagrans fungus) against infestation by gastro-intestinal nematodes was investigated on 60 yearling heifers at pasture. The efficacy of the fungus was shown mainly by a decrease in nematode egg excretion in the faeces, where the biological control method ranged between no treatment and chemical therapy. From the start of the 2003 growing season a pasture-based production system was introduced for the dairy herd (rotational grazing day and night) and initial grass growth measurements were taken.

Effects of varying grazing pressure

The first grazing experiment with dairy cattle on "L'Abbaye" farm was carried out in 2004. In the first year the introduction of regular collection of grass quality, grass growth, grass height, pasture management, milk yield, milk content, body weight and health data posed a challenge to all involved. The aim of these studies, which continued in 2005 and 2006, was to investigate the impact of varying grazing pressure respectively post grazing sward height under organic farming conditions. In brief, increased grazing pressure led to:

- better grass quality of subsequent regrowth
- reduced milk yield per animal and increased milk yield per area
- no change in milk content.

Processability of milk into quality cheese

After February 2004 problems emerged in relation to processing "L'Abbaye" Farm milk into organic Gruyère in the local cheese dairy. From January to December 2005, therefore, model hard cheese (Gruyère type) was made once a month from a conventional and an organic batch milk as well as from L'Abbaye Farm milk. 35 of the 36 cheeses made in the Liebefeld experimental cheese dairy were of good quality after 150 days' ripening. The exception was a model cheese produced in March 2005 with "L'Abbaye" Farm milk. The longer coagulation times of part of "L'Abbaye" milk could only marginally be explained by the factors of pasture-based production system, experimental activity or organic farming. The risk factors applicable to the "L'Abbaye" situation were the following:

- Processing of milk from only one farm
- Lactation stage: start or end of lactation
- Genetics: At 98 % the unfavourable AA and AB genetic variants of the kappa-casein were very well represented. Unlike BB genotypes, AA and AB genotypes result in longer coagulation times and reduced curd firmness.
- Pasture-based production systems: in pasture-based production systems there is a greater fluctuation in milk contents, something which should be taken into consideration during processing.

Understanding the effects of concentrate supplementation in pasture-based production systems

Different compositions of energy-rich concentrate supplements to full-time grazing were investigated on the experimental farm in Posieux in conformity with the guidelines for proof of ecological performance. The following conclusions could be drawn: when there is a good grass supply the effect of extra concentrate supplementation on the cow's milk yield is reduced. The type of energy chosen was less relevant. A comparison was made between barley, maize and sugar beet pulp, supposed to be carbohydrate sources with different fermentation behaviour in the rumen. Data about the effects of two different concentrate allocation strategies for pasture-based production systems – constant and milk-yield dependent concentrate supplementation - are not yet evaluated. During these experiments grass intake was estimated occasionally over the grazing season using a marker method (alkanes) and the feeding behaviour of cows was monitored with a computerised system recording and analysing jaw motions (IGER behaviour recorder).

Innovation from pasture to plate with New Zealand Holstein cattle

ALP is involved in the "Grazing Cattle Genetics" project, the aim of which is to investigate the suitability of a New Zealand strain of Holstein cattle from Ireland for milk production in pasture based production systems under Swiss conditions. ALP is particularly active in two sub-projects: grazing behaviour and the processability of milk to cheese.

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Device to measure grass growth.

Production of model hard cheese (Gruyère type) in the pilot plant at Liebefeld.

Acquisition of detailed knowledge pertaining to the fodder of milk cows

Over the past four years contacts with research institutions in Switzerland and abroad were set up and extended, leading to various joint ventures. These included three doctoral theses carried out and completed jointly with the Swiss Institute of Technology (ETH) in Zurich and the Vetsuisse Faculty of Zurich University. Two chapters of feed recommendations and feed tables for ruminants (Green Book) were also revised and made available to users online.

Prevention of metabolic disorders

A start was made on the development of a web-based check list to provide farmers and consultants with a tool for assessing the risk of metabolic disorders in their dairy cattle. For the time being the prototype, unveiled at the 2007 ALP Meeting, only contains information on identifying milk fever, although data on ruminal acidosis and ketosis will follow. Experimental studies on milk fever prevention were carried out using targeted feeding in the transition period. One trial showed that the feeding of hay with a low native potassium content has a positive effect on acid-base homeostasis in the prenatal period, thus reducing the risk of a milk fever disorder. Research parameters such as nett acid base excretion (NABE) and base-acid quotient (BAQ) in the urine showed changes in the acid base balance as early as two weeks prior to calving. Studies are currently being carried out to test their suitability as indicators for the early detection of possible milk fever disorder.

Condensed tannins (CT) in ruminant nutrition

Condensed tannins (CT) are secondary plant compounds which form complexes with feed proteins and can therefore influence the utilisation of this nutrient in the animal. It is also known that the action of CT can reduce egg excretion in lambs infected by gastro-intestinal nematodes. As the CT-containing temperate forage plants have so far mainly been freshly fed or grazed in experiments, we concentrated on investigating the palatability and nutritional value of dried and ensiled feed. Of the plants tested (chicory, sainfoin, bird's foot trefoil), sainfoin stood out both because of its high nutritional value and because the animals enjoyed eating it, despite the fact that it had the highest CT content of the three. Sainfoin was therefore selected for further trials. The results showed that the CT content of sainfoin fluctuated greatly over different growing years. Feeding sainfoin with an average level of 75 g CT/kg dry matter (DM) reduced the load on the lambs' metabolism, as reflected in lower ammonia concentration in the rumen fluid, lower urea concentration in the blood plasma and lower urea excretion via the urine. This was also observed in the subsequent trial when lambs infected with abomasal worms were fed sainfoin with a CT content of 36 g/kg DM. However, there were considerably fewer effects and values did not differ significantly from those of the tannin-free control. Nor was any reduction noted in the egg excretion of infected animals.

Importance of structural properties of feed in pasture-based diets

Young pasture grass, as provided in intensive grazing systems at the start of the grazing period, has a high level of readily soluble carbohydrates and a low level of cell-wall carbohydrates. It was therefore assumed that dairy cattle are not consuming enough feed which provides sufficient physical structure to maintain chewing activity and stabilize rumen function. In studies where grass only was fed, no negative effects on ruminating time, ruminal pH pattern or milk compounds were noted compared with when grass was fed with additional hay. No reduction in rumen function was found, even when grazing was supplemented by an average 4 kg barley or maize per day. A final evaluation of the results is still pending.

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Bird's foot trefoil (above), sainfoin (right hand) and chicory.

The spectrum of milk fatty acids is influenced by forage

The previous work programme in the Milk Quality Project focussed on the nutritional quality of milk. It was demonstrated in various trials how different feeding regimes can influence the fatty acid pattern of milk. The highlight was a conference on "The special value of grassland-based milk". Various additional studies were also conducted on the composition of goat and ewes' milk and on udder health.

The influence of different feeding regimes on the fatty acid pattern in milk

Feeding plays a central role in the composition of milk fat. Up to 50 % of milk fatty acids are transferred to the mammary gland from food fat and depot fat. In the rumen, bacteria and also protozoa are used for the rapid breakdown or conversion of some feedstuff fat. The short- and medium-chain fatty acids are formed mainly in the udder tissue.

Over the past four years various feeding trials were carried out on dairy cattle in order to study the influence of feed on the fatty acid pattern. Trials at ALP have shown that the fatty acid pattern of milk is affected by the botanical composition of the feed (natural grassland forage with a high proportion of herbs) and different types of temporary ley mixture (grass-rich mixture compared with a clover-grass and lucerne-grass mixture) as well as by the state of the feed (fresh or conserved). When animals were fed lucerne-grass mixture as green forage, the proportion of unwanted saturated fatty acids was reduced in favour of simple and multiple unsaturated fatty acids. In particular there was an increase in α-linoleic acid, a member of the omega-3 fatty acid family. The conservation of feed as hay resulted in lower fatty acid levels in the feed and produced higher values of saturated and lower values of unsaturated fatty acids in milk from cows fed with hay compared with green forage. The results of the investigation on the effect on body fat mobilisation and milk fatty acid pattern of feeding sunflower seeds prior to calving and lack of energy after calving are currently being evaluated.

Forage influences the spectrum of milk fatty acids.

Proper cleaning of the udder before milking decreases the milk germ load.

A highlight was the scientific conference on "The special value of grassland-based milk", held jointly by Agroscope Liebefeld-Posieux ALP Research Station, Profi-Lait and the Agridea Advisory Service in November 2007. At this conference various national and international scientists discussed different aspects of the opportunities and risks associated with milk production based mainly on grassland.

Decline in antibiotic use

The use of antibiotics in milk production has declined significantly over the past 10 to 15 years.

The quantity of antibiotics used for mastitis treatments and prophylaxis is roughly equivalent to 8 % of the total quantity used in veterinary medicine. However, part of the active substances employed for these reasons are thought to be more critical than many of the antibiotics used for fattening animals.

The data collected in future by Swissmedic should suffice to provide reasonably sound evidence of trends in the use of antibiotics in milk production and the risk assessments these give rise to.

The collection of data at farm level and in veterinary practices is still too expensive and prone to error to be routinely implemented.

A faster and more significant reduction in the use of antibiotics in milk production would presumably be conditional on either legal or economic incentives.

Udder infections in goats and dairy sheep

Checks on foremilk samples of individual animals during a full lactation were carried out on three goat farms and three dairy sheep farms. The study showed that 25 to 30 % of the udder halves of milking sheep and milking goats were affected by an udder infection, in the majority of cases coagulase-negative staphylococci. Staphylococcus aureus tends to be rare and streptococci hardly ever cause chronic subclinical udder infections.

The cell count of individual goat milk samples was over 750'000 cells/ml in 30 % of the samples from infected animals and 20 % of the samples from uninfected animals. Moreover, there was scarcely any connection between the cell counts in udder half foremilk samples and an existing infection. Bacteriological milk analysis must therefore also be incorporated in udder health and milk quality control programmes for goats. By contrast, cell counts in ewes' milk were similar to those in cows.

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Lasting solutions for multi-functional mountain farming

The purpose of the research project "Beef and Veal Production Systems for Marginal Areas" was to develop sustainable solutions for a multipurpose agriculture in mountain areas, while on the one hand, dealing with complements to dairy production (production of veal) and on the other hand, to other alternatives such as keeping suckling cows. These two fields of research were new to ALP in 2004.

Reduction of respiratory tract problems in calves

In the production of veal, research activities were focused on the health of fattening calves, particularly respiratory problems, with the aim of reducing the use of antibiotics. In a preliminary trial, based on the observation that the immune protection of calves may be wanting during the transitional period from passive to active immunity and that this coincides with the stress at the start of fattening, the age at which this stress occurs was studied. The youngest calves had the best fattening performance, but did not show differences with regard to their immune state and the frequency of pneumonia. In a second trial, various means for the prevention of pneumonia at the start of fattening were compared. The germs responsible and their resistance to antibiotics in respiratory problems were studied in collaboration with the Vetsuisse Faculty at the University of Bern.

Beef from mountain regions

As regards suckling cows, after the constitution of the herds in 2004, experimental work was carried out in two complementary modules with different approaches and goals. The purpose of the first module, known as the Pasto project, was to develop an extensive system with a dual function - production of beef as well as maintenance of the mountain landscape. Pasto is an interdisciplinary project funded by a private foundation, and carried out in partnership with Agroscope Changins-Wädenswil ACW for agronomic questions, Agridea Lausanne for economic and sociological aspects and the WSL Federal Institute concerning the landscape and bio-diversity. It was based on the use of the Hérens breed during suckling and based entirely in the mountains at two pilot sites: on the one hand, at a base farm at the experimental ACW field located at Frêtaz, at an altitude 1200 m in the Jura chain, and on the other hand during summering on the mountain pastures at Larzey, a brushy pasture located at an altitude of 1400 to 2000 m in Central Valais. This site was as an open air laboratory that dealt with the agro-environmental aspects of the Pasto project, in particular the interactions between the cattle and vegetation and their effects on the evolution of bio-diversity and landscape. At the zootechnical level, the performances of the young cattle of the suckling cows were evaluated in various systems while according variable weights to the function of maintenance of the landscape. The results show that it is possible to reconcile meat production in mountain areas and maintenance of the landscape. However, it is necessary provide a minimal feeding intensity during certain production phases in order to obtain, on the one hand, a quality carcass meeting market demands, particularly with regard to the fattening score, and on the other hand, a sufficient cow body condition score. From the meat quality point of view, the study dealt with criteria specifically related to the location and production conditions, particularly with regard to mountain pastures. For this, animals fattened on various pastures were compared to a reference group intensively fattened in stalls. Meat flavour profiles were established and a study of preferences was carried out with consumers. Bio-markers, a sort of fingerprint of the production site, were highlighted, offering interesting labelled marketing prospects.

Within the framework of the Pasto project, ALP examines an extensive system which allows the production of beef and veal while maintaining the landscape in mountainous regions.

In order to avoid limiting the study of the application of the results to the Hérens breed obtained in the first module, it was followed by a second study, where the goal was to evaluate various types of cattle, exclusively fed from grasslands, on their aptitude to produce meat. Four types of suckling cows, differing in size, early maturity, and milk production potential were compared for different production goals: finishing before weaning, intensive fattening of the weaned suckler calves, and extensive fattening on the pasture for two years. As well as the Hérens breed, the Angus and Limousin breeds, as well as a Limousin X Red Holstein cross-breed were used. Trials were carried out on the plains and in the mountains. Optimal combinations, between the type of cattle and production goal for given production conditions, can now be recommended to producers and will soon be accompanied by specific feed recommendations.

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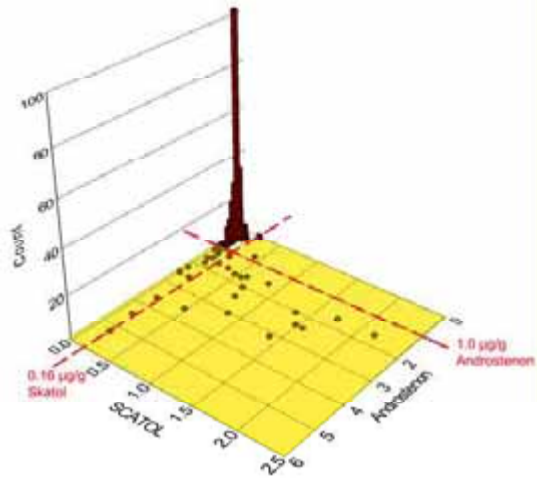
Innovative pork production

The main topics covered by the work programme were boar odour and the electronic nose, a seasonal free range production system, and mycotoxins in pig production. Implementation of the sub-projects was made possible by close collaboration with partners from agricultural consultants, industry, Zollikofen Agricultural College, Zurich/Lausanne Federal Institute of Technology and Berne University. Two doctoral theses financed by project-acquired third party funds played a considerable role in the successful implementation of project objectives.

Detection of boar odour by electronic nose

In 2009 the castration of male piglets will be prohibited by law in Switzerland if it cannot be guaranteed to be painless. One of the possible ways of circumventing this intervention is to fatten young boars, although this production method has a bad image because of the risk of young boar meat having a "boar odour". However, boar odour is very difficult to detect. It is caused mainly by substances like androstenone, skatole and indole. These substances are deposited in the fatty tissue of uncastrated male pigs and, when they occur in excessive concentrations, have a negative effect on odour and taste. Other as yet unfamiliar substances are also involved. Part of the ProSchwein Project was to devise an analytical method for the objective detection of this boar odour. Working jointly with SmartNose and Online Control, ALP has developed an electronic nose and corresponding mathematical model for the determination of boar odour. The existing analytical method can determine 98% of the samples affected. On the basis of existing know-how this laboratory method could be implemented on an industrial scale.



Reference classification using HPLC (broken red lines = limit values) and classification by electronic nose [picture on right] (area shaded yellow).

Seasonal free-range production system as an alternative

A seasonal free-range pig production system can be environmentally compatible with proper crop rotation planning. A broad 6 – 7 year crop rotation does not damage the soil, reduces parasite pressure and also allows the cultivation of grain legumes. An even N balance can be achieved if the farm produces its own protein-rich feed components. The practical implementation of this production system, which has undergone four years' testing, makes great demands on farm managers. Fattening yields of 650 g/day can be obtained, equivalent to an area productivity of 800 – 1000 kg growth per ha. This production method facilitates the production of pigs with lean carcasses but with a fat quality which still meets the requirements of the meat processing industry. One positive aspect of fatty acid composition should be mentioned, i.e. that fat from pastured pigs has higher concentrations of omega-3 fatty acids and also that the omega-6/omega-3 fatty acid ratio is tipped towards the omega-3 fatty acids. The meat of pigs from this production system has very good water retention capacity, which has improved over four years of „selection". The production system has had a negative effect on meat tenderness.

Sow grazing with piglets.

The role played by mycotoxins in pork production

The influence of the fusaria-formed mycotoxins deoxynivalenol and zearalenone on the growth and fertility of pigs was investigated over the past four years. The mycotoxin deoxynivalenol stunted the growth of pigs in all the trials conducted. In the piglet trial this negative effect was reduced by adding apple pomace to the feed. On the other hand, there were no detrimental effects on fertility from even high concentrations of deoxynivalenol and zearalenone, the two mycotoxins investigated, in the feed and bedding straw of new breeding stock and breeding sows. The results available from the many studies carried out show that the negative influence of these mycotoxins on the fertility of breeding sows is often overestimated in practice.

Fungi of the Fusarium genus attack standing cereal plants and can form poisonous metabolic products (mycotoxins).

Birth weight influences fattening performance and carcass quality

The birth weight of newborn piglets is an important economic factor in pig production, as it not only determines the chances of survival in the first days of life but also makes a considerable impact on growth during fattening, and on carcass and meat quality. Thus we have shown that pigs of low birth weight not only grow more slowly, but also form more fat in the carcass. The negative influence of low birth weight on these relevant parameters can also be non-positively influenced by specific feeding measures such as the utilisation of compensatory growth. As would be expected, birth weight decreases as litter size increases. Fortunately, the negative influence of birth weight on growth and carcass quality does not increase as litter size increases. The results available to us do not yet indicate that breeding for larger litters has a negative effect on growth performance, carcass and meat quality. The studies previously conducted were carried out on castrated male pigs. Studies are currently being carried out to determine whether these findings also apply to female animals.

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The proportion of lean meat is already influenced by birth weight.

Milk and meat processing

The cheese industry has successfully risen to the major challenge of total liberalisation of the cheese market with the EU. ALP has made a substantial contribution to this success with its work on the safety, quality, health and uniqueness of traditional Swiss hard and semi-hard cheeses. The concepts which ALP offers the cheese industry for certification of origin have aroused great interest.

Various new, innovative milk and meat products are based on scientific or technological foundations laid by ALP. Due to their functional properties, selected milk compounds are increasingly being added to other foods, thus opening up new sales markets (including exports). In meat processing ALP has now developed into a sought-after partner.

The development of expertise by ALP staff in the field of nutrition and health has led to their increasing participation in expert commissions and to their presentations being in demand at important conferences. More and more nutritional studies are also being carried out together with partners.

The disbandment of the Inspection and Advisory Service in Dairy Economic Matters (MIBD) at the close of 2006 brought a unique success story to an end. The advisory service is being continued by various regional institutions. ALP has been able to establish close working ties with these institutions at various levels, taking on new challenges at the same time. The link between ALP research and commercial practice was further strengthened by the very successful transfer of the approved model of the cheese sector to the dairy and meat processing sector.

ALP tested various kinds of skins for cervelat sausages.

Cheese Quality Project

Applied cheese research for cheese makers and consumers

In the work programme a great deal of research in the Cheese Quality Project focussed on the quality, nutrition and proof of origin of Swiss cheese.

Guaranteed proof of origin for Swiss cheese thanks to ALP cultures

When the cheese trade with the EU was deregulated in 2007, the conditions underlying the marketing of products from Swiss cheese makers changed radically. Although the high quality of Swiss cheese is internationally recognised, further efforts must be made to ensure the clear market positioning of this premium cheese. Advertising traditional production methods and stating origin are becoming increasingly important in the marketing of agricultural products. Ten varieties of cheese have already been registered with the Swiss Federal Department of Agriculture as products with a protected designation of origin (PDO).

PDO products inspire consumers with confidence in their quality and naturalness. It is important to authenticate such cheeses by analytical methods as this boosts consumer confidence, at the same time allowing action to be taken against fakes. The previous work programme therefore saw more intensive research work on proving the origin of Swiss cheese using ALP cultures. The development and application of new molecular biology methods for the genotypical characterisation of ALP cultures has opened up many new opportunities for ongoing development of the culture range. As most traditional varieties of Swiss cheese are made exclusively with cultures from ALP, it is, for example, cheap and easy to check the Swiss origin of an Emmental cheese by DNA analysis. In the industry this work has aroused great interest in the development of exclusive PDO cultures. The development of initial PDO cultures with an integral certificate of origin is already well advanced and is being continued in close collaboration with the involved cheese associations.

Cheese – a valuable food in the human diet

Health and wellness count among the major consumption trends and influence consumer purchasing behaviour. This also explains the rise in sales of functional foods with additional health benefits, among which dairy products occupy a dominant position. ALP has therefore endeavoured to keep assembling the latest findings on the importance of animal foods in the human diet and make these available to interested groups in suitable form. The composition of cheese means that its consumption plays an important part in the supply of important nutrients. In addition to macro - and micronutrients, cheese can also contain compounds of physiological relevance, for example bioactive peptides. These are protein breakdown products with a physiological effect. Interest in investigating bioactive peptides has risen sharply since blood pressure-lowering peptides were discovered in fermented milk in the mid 90's. Various countries including Switzerland saw

the market launch of functional sour milks designed to have a beneficial effect on blood pressure, so ALP has also carried out in-depth research into the occurrence of the two blood pressure reducing peptides Valin-Prolin-Prolin (VPP) and Isoleucin-Prolin-Prolin (IPP) in Swiss cheese. A method developed by ALP has for the first time made it possible to check an extremely wide variety of cheeses for levels of these two peptides. To our surprise, relevant concentrations of these peptides were found in samples of Bernese alpine cheese and Hobelkäse [planing cheese] and in other varieties. The occurrence of these peptides in selected varieties was therefore examined at greater depth in follow-up studies and the influencing factors contributing to their release were identified. Levels of these peptides were also investigated while whole cheeses of various varieties matured, and important basic principles were thereby formulated for the future development of blood pressure-reducing cheese.

Close collaboration between research and practice

Enjoyment is the yardstick used by consumers when eating cheese. In production and research, however, the term "cheese quality" covers an extensive range of criteria. In the current programme various trials were carried out jointly with practitioners on the optimisation of cheese quality. The technological emphasis here was on optimising hole formation in semi-hard cheese and improving the meltability of Raclette. In the food safety sphere an in-depth study of biogenic amines was conducted because of the trend towards extra mature cheese specialities. Here even low concentrations of microbially formed substances can lead to headaches, queasiness and nausea in sensitive consumers.

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ALP public relations during the cheese rolling contest at Zurich's main railway station.

LC-MS apparatus for the quantification of bioactive peptides in Swiss cheese having an effect on blood pressure.

Leading the field with new cultures

ALP's development and production of cultures for making cheese and sour milk products is highly rated by the Swiss dairy industry. The naturalness of these cultures (most are of bud quality) and their provenance from existing Swiss biodiversity offer potential promise in differentiating Swiss cheese and dairy products from foreign competition.
Over the past 4 years ALP has developed and brought to market no fewer than 9 new starter and surface cultures.

Extending the range of cultures on offer

One important goal in the last 4 years has been to extend the available range of cultures towards mesophile cultures. Mesophilic strains from the culture collection were extensively investigated and tested for their suitability in the production of semi-hard and soft cheese. The results led to the launch of mesophilic culture MMK501 on 1 February 2005. The culture has proved itself in the field and acquired a considerable number of regular customers in a short time.

PDO cultures: a success story

Products of protected designation of origin (PDO - in french AOC) generate added market value as traditionally made products with a geographically defined origin, but well-known PDO products run the risk of being copied. In close collaboration with Interprofession du Gruyère (IPG) ALP has developed a total of 3 new starter cultures (2004: PDO G1; 2006: PDO G2 and PDO G3) for the production of Gruyère PDO. The exclusive nature of the cultures is based on their provenance. They were isolated in the 80's from quality production facilities within the Gruyère PDO region and preserved by ALP in freeze-dried form. These strains were reactivated to develop the PDO starter cultures and carefully tested in the laboratory, pilot plant and in the field.

In the last working period ALP was also successful in devising a specific method for proving the origin of Swiss PDO cheese simply on the basis of cultures, thus permitting hugely improved protection against counterfeit products. Since the possibility of developing such cultures with a certificate of origin became known, several development orders have been received from classification organisations.

The development of specific cultures for the production of PDO cheese is a forward-looking service by ALP to the Swiss cheese industry, and not least to consumers increasingly aware of original, typical and regional products when purchasing Swiss cheese.

Shortly before the first preserved culture was introduced

A major objective was to offer selected cultures in dried form which, according to various customer surveys, met a great need in the field. As the attainment of this goal is of great strategic importance to ALP and affects one of its core competences – culture development and production – a preliminary study was carried out and, building on that basis, a concept for the future development (2004 to 2011) of cultures drawn up. Initially the development of a lyophilised, mesophilic culture was tackled. A great deal of effort was invested in this goal over the past 4 years. Results show that ALP has made huge strides in the freeze drying of cultures and it is anticipated that 2008 will see the inclusion of the first lyophilised culture in the mail-order range.

The DPO cultures of ALP allow the determination of origin.

Great effect from flavour cultures

Cheese producers have a great interest in "flavour-forming cultures" so that they can give their products a characteristic note and differentiate them from those of other suppliers. Over the past 4 years various strains from the culture collection have been investigated for their flavour formation. In collaboration with Emmi group a flavour-forming strain was developed for the production of Yogodu - a semi-hard cheese with a fresh yoghurt taste. The culture has been used for the production of Yogodu since October 2007.

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Semi-hard cheese with a fresh yoghourt taste obtained with an ALP aromatizing culture.

Innovations in commercial cheese production

Various promising practical processes were developed in the areas of "New Processings for the Production of Cheese" and "Goat and ewe's milk processing".

Fresh, soft and semi-hard cheese from MF concentrate

ALP developed a method of producing fresh cheese and soft cheese from MF (microfiltration) concentrate. Here the processing milk is concentrated to the dry mass of the subsequent cheese mass, and the concentrate then processed straight into curd and soft cheese. Many trendy innovative forms are feasible, as whey need no longer be removed from the cheese. For semi-hard cheese ALP developed a process with greatly simplified curd separation so as to obtain the desired water content, a good cheese matrix and fine hole formation.

The micro-filtration process makes it possible to develop many innovative modern forms.

Cheese made from silage milk thanks to microfiltration

ALP succeeded in using microfiltration to remove foreign bacteria, and particularly butyric acid bacteria spores, from silage milk so that soft, semi-hard and hard cheeses can subsequently be made from the purified milk without heat treatment. This new process makes possible the safe production of new cheese variants with a raw milk character. This technology opens up interesting opportunities, especially for medium-sized farms. Various cheese dairies are currently considering the purchase of microfiltration plant as an alternative to a Bactofuge.

Mild ewe's and goat cheese increasingly popular with the Swiss

In a consumer test at Huttwil cheese market ALP asked just under 700 people for their opinion on two goat and two ewe's milk cheeses available on the market. Goat and ewe cheese are increasing in popularity for numerous buying motives such as "something a bit different", "special taste" and "healthy products".

But please make sure they're mild ! The survey very clearly showed that too strong a "goaty" flavour tends to be unpopular, so cheese should only taste slightly of sheep or goat.

Consumers appreciate mild ewe and goat cheeses

Standard recipes for goat and ewe's milk processing

Numerous technological trials were carried out in this booming sector and now, in addition to fresh and soft cheese, a recipe has been developed for a semi-hard cheese of each type. In the process it became clear that because the milk of small ruminants fluctuates in quality and seasonal content, in practice such recipes need to be adjusted to farm-specific circumstances.

Mozzarella and ricotta from ewe's milk – innovative method with high added value

A recipe was successfully devised for the production of mozzarella from ewe's milk as part of a diploma dissertation in collaboration with the Swiss College of Agriculture. The whey from this process can then even be made into ricotta, thus obtaining optimum added value from this expensive raw material. Gentle milk pretreatment, rapid souring and a low stretching temperature guarantee the success of a ewe's milk mozzarella which is not too solid or tough but as stretchable as cow or buffalo milk mozzarella and like chicken meat in the final product.

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Mozzarella manufactured from ewe's milk as a result of a new recipe.

Transfer of knowledge marked by change

Work in the "Practical Implementation" project was shaped by structural change in the dairy industry and the disbandment of the Dairy Industry Inspection and Advisory Service. Support of the Swiss dairy industry in its aspirations for quality leadership is continuing successfully with new partners.

Collaboration with the new advisory organisations

When the new Milk Quality Ordinance came into force on 1 January 2007 the cantons became responsible for maintaining an existing Dairy Industry Inspection and Advisory Service (DIIAS). DIIAS was disbanded and, depending on the region or canton, the advisory service was transferred to civil law organisations or incorporated with the agricultural advisory service. ALP had monitored this process intensively, indeed the regional advisory services are important partners in the exchange of knowledge between research and the real world. Reorganisation of the dairy industry advisory service necessitated that collaboration be put on a new basis. Joint venture contracts containing agreements on consultancy, further education, field trials, communication and cultures were concluded with all the advisory platforms by spring 2007. At the same time the tariffs for farm advisory services were fixed by ALP so that ALP did not compete with the regional advisory services on price. The first year's collaboration has produced a positive balance sheet.

Proven and new ways of purveying knowledge

ALP's performance-action model places great importance on exchange of knowledge with those in the field. Thus ALP played a major part in ensuring that the training and ongoing professional development of those employed in the dairy industry matched the state of the art. Its contributions ranged from the practical preparation and provision of knowledge in numerous publications, technical papers, and expert opinions through ongoing professional development within the framework of advisor conferences and cheesemaker discussion groups to teaching students at the Swiss College of Agriculture (SHL) and carrying out practical training, term papers and diploma theses.

The study groups also led to new methods of knowledge transfer. A collaboration by two study groups ("Lutte contre l'oïdium sur le Gruyère" [Combatting mildew on Gruyère] and "Chargenfabrikation Emmentaler" [Batch production of Emmental cheese]) made it possible to gather initial experience in this form of knowledge exchange.

Discussion group topics adapted to practical conditions have been published in the ALP forum series since 2004. Today these publications are familiar not only to professionals, consultants and teachers at home, but are also arousing interest abroad thanks to their accessibility on our home page.

Dairy consultancy, a new service

Since the summer of 2005 ALP has had a dairy consultant in the person of Walter Strahm. The newly created post showed that ALP also considered small and medium-sized dairies to be important industry players. The dairy consultancy service became known in the field by establishing personal contact, by newsletters, talks and publications. Today it is well used.

Topics old and new occupy those in the field

The acknowledged high quality of Swiss dairy products is a testament to the successful implementation of research results in the field. However the increase in large claims due to quality defects in raw milk shows that structural change in the dairy industry is having an impact on milk processing. The major field trial on the effect of increasingly popular automated milking systems on milk quality, initiated in 2006, is an example of how research at ALP picks up important issues from the field. The subject of food safety is gaining steadily in importance – a consequence of the increasing spread of civil-law food safety standards as well as new food hygiene law – so the subject also played a dominant role in cheesemaking discussion groups and in the ongoing training of regional consultants. In this context ALP's assistance in revising FROMARTE's QM Manual also represents a very important contribution to the practical implementation of new findings. The manual is being reissued in 2008 and will then be the mandatory GHP guideline for commercial cheese makers.

Successful cultures

Fermentation organisms play a key role in the production of fermented milk products. ALP therefore renders an important service to domestic milk processors by developing, producing and distributing cultures. The sale of cultures has been in decline since 2003 due to the closure of cheese dairies, but new cultures have reversed this trend. The new mesophilic starter culture MMK 501 has played a particularly important part here. Exclusive cultures for PDO cheese were included in the product range for the first time (3 cultures for Gruyère PDO). The MK 174 culture is also off to a good start. The surface culture offering was expanded by two already very popular cultures, red smear culture OMK 704 and culture OK 710 – Anticollanti. The supply of OMK 702 in more economical litre bottles was also very well received by the market.

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ALP's job is only complete when new findings are successfully implemented in the field.

Acquisition of new knowledge concerning milk constituents and nutrition

In the Work Programme of the Milk Processing Project various studies were carried out on the application of milk constituents in foods, nutritional research and technology, and relevant methods developed for the dairy industry. Interest in the field was backed by applied research.

Innovative utilisation of by-products

New solutions for the utilisation of by-products like whey and ultrafiltration (UF) permeate are much in demand from the dairy industry. The extraction of sugar solutions could represent an interesting way of increasing added value in the manufacture of milk products. Laboratory-scale studies carried out at ALP demonstrate a new process method representing a combination of nanofiltration and lactose hydrolysis. Here the economic viability of the process is significantly improved by using the enzyme several times. There are many uses for the three products manufactured in this way. To adjust sweetness and reduce the freezing point to the desired level, for example, partially demineralised sugar syrup is an ideal ingredient in ice cream, as it is in beverages, sauces and other sweetened foods. This syrup serves primarily as a sweetener to replace sucrose or glucose syrup. Mineral-rich sugar syrup is ideal for use in salted or seasoned products. It is rich in polyvalent minerals and therefore suitable, among other things, as a component for the adjustment of melting properties in the cheese sector. Lactose-mineral concentrate, for example, could be used as a fermentation substrate in sausage production or as an animal feed additive. Price will be the key factor in determining the sales potential of new products made from UF permeate. The selling price of sugar syrup per kg of dry matter should not therefore exceed the price level of sucrose or glucose syrup.

Determination of phospholipids in milk products

Emulsifiers are surface-active substances which have a polar water soluble side and a nonpolar fat soluble side. In a mixture of water and oil they bring about a reduction in interfacial surface tension, thus stabilising the emulsion. Until now mono- and diglycerides have frequently been used as emulsifiers in the food industry. Many consumers have reservations about additives, so increasing use should be made of natural food ingredients as emulsifiers. Phospholipids also influence the interfacial surface tension between water and oil and enable the formation of an emulsion. In the food industry they are therefore used for emulsification, dispersion, instantisation and the like. Phospholipids occur in amounts of 0.8-1.0 % in milk fat. Use of the technological functionality of phospholipids from milk or milk products presupposes the possibility of quantitative recording. Currently the fat is extracted from the product under investigation. The problem here, however, is the distribution of phospholipids in the hydrophilic and lipophilic phase. This is particularly evident in low-fat milk products. The object of the work carried out at ALP was to develop a method which is independent of the fat content of the milk product. In this method

The ALP pilot plant at Liebefeld.

the phosphorous organically bound to the phospholipids must be differentiated from the inorganic phosphate as well as from the organic casein-bound phosphorous fraction. To do this, the fraction of inorganic phosphorous and phosphorous bound to casein by phosphoserine is determined in the total phosphorous. The phosphorous originating from the phospholipids is then recorded by differential calculation. The method developed at ALP allows the quantitative determination of phospholipids irrespective of the fat content of the milk product and without the use of (carcinogenic) solvents. Inorganic phosphorous can also be differentiated from organic phosphorous. Phospholipids extracted from milk or milk products can therefore be incorporated in food manufacturers' recipes as natural emulsifiers.

Are trans fatty acids formed when milk fat is heated?

Trans fatty acids (TFAs) from partially hardened vegetable fats are said to have a negative effect on human health, mainly in respect of the risk of cardiovascular disease. Milk fat naturally contains TFAs which on the basis of current knowledge pose no danger to human health. The question is whether the heating of milk fat creates additional TFAs which cannot be vouched for as harmless. ALP was therefore commissioned by the butter industry organisation (BOB) to investigate whether TFAs are produced when butter, pure butterfat and pure butterfatcream are heated. The three products were heated for 20 and 60 minutes to 180° and 220° C, then analysed for their TFA content analogously to fresh, unheated products. No statistically significant difference in TFA concentration was found between any of the heated samples and the unheated milk fat, i.e. no additional trans fatty acids were found, even after 60 minutes at 220° C. The minimal changes were in the measurement uncertainty range. Only the TFAs naturally contained in milk are detectable here, so milk fat can be used without reservation in hot cooking.
In communication and knowledge transfer ALP has made a major contribution to the perception of subtle differences between natural animal and industrial TFAs.

Sows as a model for humans in nutritional studies

Pigs are monogastric animals whose nutrition and digestion demonstrate strong similarities with those of humans. On this basis a study was carried out at ALP to evaluate the transition of conjugated linoleic acid (CLA) from feed to sow's milk. The fat source in the

feed was replaced by alpine butter rich in CLA and by margarine as a control diet. The study showed that a 10 day course of lactation feed mixed with alpine butter increased the CLA concentration of the milk fat in the sows' milk, by contrast with a feed containing margarine. The fatty acid composition of the feed was reflected in the milk fat of the sow's milk. This study proves that sows are an acceptable model for humans. The ability to standardise and monitor individual influencing factors such as feed composition and housing conditions is a clear advantage vis à vis human studies. In addition, the Posieux site provides excellent basic local conditions, many years of experience and a high degree of specialist knowledge. It would therefore seem appropriate to use pigs for further studies in the field of human nutrition.

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Influence of milk processing on conjugated linoleic acids

The European Union is funding the € 18 million Quality Low Input Food project within the framework of the central issue of food quality and safety. The aim of this project is to improve the quality, safety and productivity of low input foods. 34 research institutes, universities and industry partners throughout Europe are taking part. The key subproject involving ALP related to processing strategies. The possible effects of processing on nutritionally valuable milk constituents were investigated using conjugated linoleic acids as an example.

ALP participation in the EU "Quality Low Input Food" Project (EU-QLIF)

Recent studies show that conjugated linoleic acids (CLA) occurring naturally in milk and milk products may have anti-mutagenic, cancer-inhibiting, anti-diabetic and arteriosclerosis-inhibiting effects on human health. Processing standards for organic foods aim to retain or fortify the specific bioactive or functional components of the raw materials and to ban processing methods which could adversely affect nutritional value. There is increasing consumer demand for foods with a natural nutritional advantage over comparable conventional products. The object of the first study was to provide an overview of the current state of knowledge on the effect of milk processing and storage on the CLA content of the end product. In recent research work on the effect of heating steps during milk processing and storage no changes were observed in CLA content or CLA isomer profile. In commercial fermented milk products, no fermentation influence was found on CLA content or CLA isomer profile. The latest studies showed no change in the CLA content of cheese during production or ripening. The CLA level remained stable during the production of fermented butter from CLA-enriched cream. This was confirmed by our own investigations into butter made from fermented cream. Various methods of determining the oxidative stability of butter were also developed

Analysis of the CLA content of the butter fraction in an ALP laboratory.

at ALP and Kassel University, and the storage stability of CLA-enriched and conventional butter was investigated as well.
Trials conducted as part of the evaluation of a fractionating process for the low-input enrichment of CLA in milk fat showed that the physical separation process chosen, which met with acceptance in international organic circles, facilitates enrichment. Here triglycerides containing CLA are found in both the olein and stearin fraction. Depending on the composition of the triglyceride and the crystallisation point determined thereby, the bound CLA isomer passes into the stearin fraction or the olein fraction during fractionation, something difficult to achieve enrichment by a purely physico-mechanical method. In both types of butter, however, the higher proportion was found in the olein fraction. Whereas in pure butterfat CLA enrichment of 32.5 % was obtained in the olein fraction, enrichment of only 15.3 % was shown in alpine butter. In view of the expensive multi-stage process, this is low for the industrial scale and also too low to have decisive positive effects on health.

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The Swiss meat industry is increasingly being backed by practical research!

As part of its strategic alignment policy the Federal Department of Agriculture commissioned ALP's two predecessor institutions to draw up a "Meat Processing" research concept in 2003 and to start building up the corresponding research division in 2004. In line with investigation results the new Division was geared primarily to the subject fields of technology and nutrition. Important milestones in its realisation were contractual collaboration with the Swiss Meat Industry Training Centre, the creation of the post of a Meat Consultant, and the conduct of diploma and doctoral dissertations.

Fat index – influence on meat product quality
The fat score is an important variable for fat quality in pigs and, owing to possible price reductions, led to repeated discussions between producers and processors. Dependent on fat score, therefore, four meat products (salami, Rohesspeck [raw-cured bacon], wieners, pork hamburgers) were made and tested with reference to different quality parameters. Because an influence on fat score could only be found in the air-matured meat products, and only for isolated features, the direct derivation of an objective limit value proved impossible on the present basis.

Meat starters – using ALP competences in the cheese sector
In addition to various early literary articles and a study of 13 trade cultures, an early experiment involved the use of two cheese surface cultures on salami. Unfortunately it transpired that neither culture could compete with the surface moulds commonly used for meat.
Around 500 isolates from 25 different, spontaneously fermented samples of raw sausage from all over Switzerland were subsequently isolated, characterised and typified. The resultant isolates are being used as the basis for a Commission for Technology and Innovation (KTI) project which includes a joint venture with the Swiss Federal Institute of Technology in Zurich [ETH Zurich] and an industry partner on the development of a meat starter culture with additional benefits.

Authenticity – proof of origin of dried beef and poultry meat
The aim of a joint dissertation with the Federal Department of Health, ETH Zurich and other institutions was to draw direct conclusions as to the geographical origin of dried beef and poultry meat using analytical methods. To this end around 50 samples were subjected to a wide range of analyses in an initial phase, with element analysis, oxygen isotopes, NMR, NIR being the methods which emerged. To date examination of a sizeable number of samples has shown that, although it is possible to differentiate completely between some countries by the aforementioned methods, differentiation between other origins is possible only on occasion.

Processing of cooked sausages for an ALP-study at the ABZ Spiez.

Regional, natural meat products – niche products with potential

As part of a joint venture with the Waadtland Association of Master Butchers a field survey was carried out to relate the individual production steps in the fabrication of Waadtland raw sausage to sensory assessment of the relevant end products. An experiment carried out on this basis with Waadtland sausage showed that, subject to good production practice, total salt content could be reduced from the usual 18 or 19 g to 16 g per kg sausage meat; replacing 50 % sodium nitrite with sodium chloride had no effect.
Another study dealt with the development of a pure beef raw sausage. Whereas initial trials with a large calibre (still) failed because of adjustments to maturing conditions, a 55 mm calibre product produced a positive reaction from the industry.

Meat technology – a broad spectrum of open questions

In a diploma thesis carried out in collaboration with the Life Sciences and Facility Management Department of the Zurich College of Applied Sciences (ZHAW), a Lyoner sausage was developed without additives which have to be declared as E numbers. Together with the Association of Schaffhausen Master Butchers, ALP then built on this to create the Schaffhauser Metzgerwurst, given its market launch in May 2007. In further trials – including another diploma thesis with ZHAW – it was shown that in Lyoner sausage the addition of 3 % total milk protein is a good alternative to the common addition of phosphate.

As part of a commissioned study ALP collaborated in the development of a phosphate-free cooked ham, of which the sodium content was reduced by 30 %. Moreover, in Lyoner sausage where some of the pork fat was replaced by inulin, it was possible to reduce fat content by up to 50 %.

A second doctoral thesis with ETH Zurich concentrated on the structural defects of cooked ham occurring in practice. Following an extensive survey of the type and frequency of defects, various physical and chemical methods were used to investigate different batches of cooked ham in greater depth, with reference both to the characterisation of structural defects and the influence of reduced pH in the raw material on the quality of the resultant cooked ham. Results so far show that it is difficult to differentiate structural defects analytically and that pH pattern has no influence on the defect.
Two further areas of work dealt with the suitability of a small climate chamber and a soft separator, which demonstrated other interesting alternatives for practical application.

Nutrition – impartial assessment of meat as a food

For a long time a great variety of nutritional prejudices have attached to meat as a food. Various ALP papers (e.g. on salt, fat, trans fats, selected vitamins and trace elements) are increasingly contributing to a neutral assessment of meat in the diet. A variety of analytical studies are also under way to establish a database on the nutritional value of meat products.

Method developments

The build-up of expertise on meat processing initiated in 2003 was accompanied by the development of various analytical methods:

- constituent substances: raw nutrients, minerals, vitamins (B1, B2, B6, A, E), fatty acids (highly soluble, CLA), selected muscle proteins
- physical parameters: firmness, peelability, aw value
- sensory languages: salami, Lyoner sausage (with existing Fresh Meat Panel)

Knowledge transfer

The newly formulated findings were shared with interested parties by way of scientific publications as well as by many practical articles in various specialist journals. The dissemination of new information via the mail letter issued 2-3 times per year proved especially valuable; by the end of 2007 this had already reached around 500 addresses. A meat processing subject area was created on the ALP homepage. Increasing use is also being made of direct methods of knowledge transfer, i.e. delivering lectures, debating topics in discussion groups and various public events (e.g. 2005 Open Door Day, Mefa 2007).

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Safety and quality

Various new requirements for the compound feed industry were introduced and implemented in the field of hygiene and quality assurance (HACCP concepts), involving a major deployment of staff at Official Feedstuffs Inspection. On the other hand, there was a marked easing of the situation on feed investigations relating to BSE eradication. No further animal meal contaminations have been found in recent years and there has also been a substantial improvement in the number of diseased cows. The cattle disease BSE has been overcome in Switzerland, not least thanks to the strenuous efforts of both the animal feed industry and Official Feedstuffs Inspection at ALP.

Bee mortality was the most important issue in bee research. There seem to be various reasons for the enormous colony losses. The Bee Research Centre at ALP is coordinating an international group of researchers, beekeepers and industry representatives who are tackling the problems of colony loss in detail. The Small Hive Beetle poses another possible threat to bees. This honey bee pest could cause huge problems if introduced into Switzerland. Bee health will continue to be of great importance in the years to come; in its plans for bee research ALP has borne these challenges very much in mind.

Dead bee colony from the winter with higher-than-average colony losses.

As far as analyses of animal feedstuffs for the eradication of BSE are concenrned, the situation turned into normal.

Feed inspection to protect health and prevent deceit

In the last four years, in addition to routine control of feedstuffs, the main tasks of the official control of feedstuffs were: the higher requirements concerning the control of companies; the extension of control to the field of the pet foods; the crowned successful fight against BSE.

Product inspection

A total of 1,353 feed samples taken from livestock feed were analysed in 2007. A break in the positive trend of past years was noted. Minor complaints were more than 7% up on the previous year at 42%. The number of serious defects had risen perceptibly to 15.4%, whereas over the last few years this figure had fallen from 15% in 2001 to 11.5% by 2006. As last year, an offence had to be reported to the authorities in one case.

There are no signs as yet of a significant improvement resulting from the pet food product inspection started in 2005. As in previous years, during the year under review around 82% of the pet food sampled gave rise to complaints. These mainly concerned incorrect declarations and, in some cases, impermissible health claims.

Counterfeit maize gluten from China has posed a challenge to the feed market and to feed inspection. The legal requirement for marketers to withdraw feed from the market in cases of suspected insufficient feed safety did not work initially. A total of 2,500 tonnes of counterfeit maize gluten were imported from China. As the pictures below show, counterfeiting is not visible to the naked eye, but it is clearly apparent under the microscope.

Measures to counter BSE

The measures to counter BSE have produced gratifying results. None of the feed samples were found to contain residues of prohibited animal material. Also, the number of animals suffering from BSE fell to zero in 2007.
As a reminder (year/cases): 2001/42; 2002/24; 2003/21; 2004/3; 2005/3; 2006/5.

Special analyses

Mycotoxins: Perceptible contamination with deoxynivalenol was found in approximately half the wheat and triticale lots in 2007, and slight contamination in maize grain.

GMOs: None of the 173 starter products analysed showed any traces of genetically modified organisms (GMOs). On the other hand, 13 out of 279 feed mixes analysed were found to contain them. There were three incorrect declarations among livestock feed products and nine among pet foods.

Heavy metals: The arsenic, lead, cadmium and mercury contents of various feeds were determined. None of the products exceeded the specified maximum levels.

Medicinal plants and health claims

A list of medicinal plants that must not be included in feed was drawn up in cooperation with Swissmedic, the Swiss Agency for Therapeutic Products. The occurrence of impermissible health claims in respect of feed was also pursued and complaints were made if necessary.

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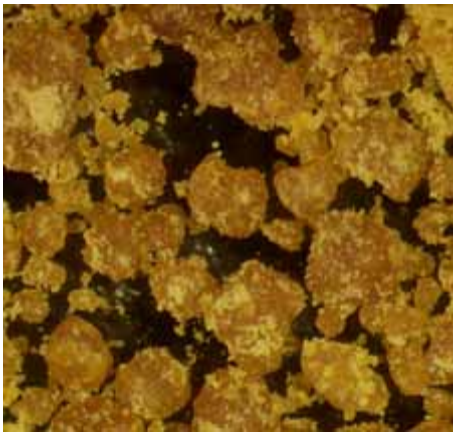
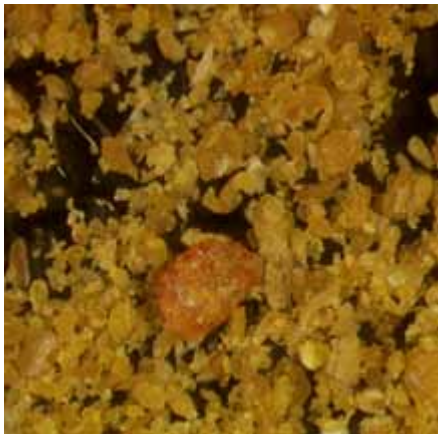


Genuine maize gluten, 6.3 x magnification



Counterfeit maize gluten, 6.3 x magnification

Guaranteeing high-quality milk and dairy products

The closure of the central federal inspection and consultation service in dairy economy SICL and its reorganization was the main activity during this period.
Moreover, initial collaboration in the field of the evaluation of the risks concerning milk and dairy products were accomplished and hygiene monitoring was set up.
In addition to this, the laboratories now have an alternative method for the determination of milk fat.

The project ist meant to support authorities, firms, and organisations in their assessment of milk and milk products.

Redistribution of the tasks for the quality control of market milk

Until the end of 2006 the Swiss Federal Dairy Inspection and Advisory Centre at ALP looked after technical supervision and coordination of the Dairy Industry Inspection and Advisory Service (MIBD). Since 1st January 2007 cantonal departments have been responsible for carrying out inspections of milk-producing and -processing operations. The quality control (QC) of milk for commercial use was put out to public tender and awarded to competent independent test facilities. The third MIBD function, the advisory service, was virtually all delegated to the industry.

The disbandment of the MIBD resulted in the Centre's objectives and functions being transferred to ALP, the Federal Veterinary Office (BVET) and the Federal Office of Health (BAG). Implementation support at ALP includes sitting on the QC Expert Committee, particularly for the National Reference Laboratory function, the evaluation and publication of QC data, participation in the "Milk Enforcement Unit ", the provision of technical support to Federal Government and cantonal agencies on issues relating to milk production, processing and inspection.

Risk assessment and food safety

In 2006 the area of risk assessment was incorporated into the Peer Review at ALP. The peers acknowledged the work previously carried out on chemical contamination (e.g. polycyclic aromatic hydrocarbons in Swiss dry fodder) and microbiological contamination (e.g. the fact sheets on microorganisms). The peers particularly recommended continuing national and international networking together with a commitment to the prevention of bio-terror attacks. To date there has been initial cooperation with BVET, LABOR SPIEZ and BAG. Specialist technological expertise and experience gained from various modelling exercises went into the «Risk Assessment for the National Milk and Dairy Products Research Programme» and articles on *C. botulinum*. In 2008 ALP started operating a food safety platform for the coordination of relevant issues.

Hygiene monitoring for milk and dairy products throughout Switzerland

Milk and dairy products are very valuable foods and constitute an important source of many vital nutrients. On the other hand, they can be contaminated with pathogens which cause infectious diseases and spoilage, which is why it is so important to observe hygiene precautions when collecting and processing milk. By acknowledging equivalence in the trade in foods of animal origin and the adoption of the EC hygiene package, Switzerland also committed itself to hygiene monitoring. To this end a risk-based national sampling plan, first implemented in 2002, was devised jointly by BVET, the Association of Swiss Cantonal Chemists and ALP. Risk assessment was revised in 2007, and updated and consolidated on the basis of previous years' data. The recommendations were incorporated in the research programmes of subsequent years.

Close examination of milk fat determination

The fat content of a dairy product is a quality feature and is mostly determined using high-speed methods. Although the Gerber butyrometric method of 1892 is used in many laboratories because it is simple, fast, favourable and can be applied to high sample numbers, butyrometry does have drawbacks. The cream butyrometer was used to demonstrate that butyrometers have high variability and sometimes show systematic deviations to the reference method (Röse-Gottlieb). For a 100 years and more there have been publications on individual aspects of butyrometry and proposed solutions to recurrent measurement problems. Butyrometers can be viewed as "chemical reactors" with many processes and variables, some of them difficult to grasp.

The introduction of high-precision densitometers has provided an alternative method to butyrometers. The procedure gives identical results for samples of milk, cream and cheese samples as determined by the reference method. Ecological and economic benefits will accrue to laboratories from possible partial automation in routine use and an improvement in laboratory safety.

Validation of BactoScan FC for the assessment of raw milk bacterial load in Switzerland

BactoScan FC is the unit succeeding the BactoScan-8000 hitherto used. Its introduction in early 2007 called for comparative testing because the official quality limits for raw milk were specified in BactoScan-8000 measurement units ("impulses"). From 1 March 2008 BactoScan-FC units will be converted into bacterial counts commonly used in the EU.

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Your partner for improved quality

Following the merger of FAM and RAP in 2004, the new research station has developed a high level of specialist expertise in the quality and safety of foods of animal origin. That specialist expertise in the area of the quality and safety of foods of animal origin has been much in demand over the last four years.

Consultation on problems with pathogenic germs

Requests for advice on Listeria have come both from Switzerland and the EU. In eight cases the ALP Listeria consultancy team was called in by producers in acute problem situations to design and assist with partial or total clean ups. Two of these are still on going, and the other six assignments have been successfully completed. All six firms are back on the market again and are producing to the entire satisfaction of their customers and the Cantonal authorities. Two other assignments were of a preventive nature, that is to say, the firms called in ALP experts to check the exhaustiveness of their safety concepts and identify any weaknesses. An analysis of the last twelve years shows that producer support by the ALP Listeria consultancy team is having a lasting impact: in 85% of cases the measures taken proved effective in subsequent years, and no more findings of *L. monocytogenes* occurred thereafter.
ALP's specialist expertise was also in demand to advise on and assist with cleaning up problem situations involving Salmonella, staphylococcal enterotoxins (SET) and *E. coli* (VTEC). The findings from these assignments are incorporated into ALP's quality advice programmes and help to optimise the producers' own quality assurance measures.

Honey quality analysis for Swiss beekeepers

VSBV, the umbrella association of Swiss beekeepers' associations, has introduced a seal of quality for honey. Only members of the sections affiliated to the VSBV and its national associations are eligible to take part in this quality programme. They undertake to comply with the special quality requirements concerning production and the product and they are authorised to use the seal of quality. Any pesticides used must not leave harmful residues in the honey. Random honey samples are collected from the sections by the VSBV and analysed by ALP to identify any suspect substances so that countermeasures can be taken before a problem arises. ALP has developed an analytical platform for beekeepers in cooperation with the VSBV. The programmes of work and the annual topics are planned and carried out by the VSBV Honey Committee and specialists from ALP's Bee Research Centre. That way, Swiss honey quality analysis is carried out in Switzerland itself.
The 2007 OLMA Honey Prize was the first award for which only honeys bearing the VSBV's Golden Honey seal of quality could be entered. ALP's role in connection with the award was to make sure that all the honey (taste) samples submitted and of course the prize-winners met the VSBV's high quality standards.

Mycotoxins platform – feed knowledge transfers

Feed manufacturers are increasingly availing themselves of the opportunity to obtain advice on the quality and usability of their products submitted for analysis. The number of analyses for quality assurance purposes carried out between 2004 and 2007 increased significantly overall. There have been frequent requests for analyses to determine the fatty acid pattern, screening for antibiotics, mycotoxin determination, GMO identification and microscopic examination of feed for animal bone and muscle fibre fragments.
The Internet mycotoxins platform went live in 2007. The aim is to present Agroscope's research work to a wide audience. Mycotoxins, also called fungal toxins, are secondary metabolites produced by fungi. Even in low concentrations, they can be toxic to humans and animals. Researchers at Agroscope describe the current state of the search for ways of preventing mycotoxin contamination of agricultural animal and plant products. In addition, monitoring and control of mycotoxin levels constantly ensures the safety of harvested crops.
You can find a compilation of our own research results along with relevant information from other sources under *Topics – Mycotoxins – Publications* on the Agroscope mycotoxins platform (www.art.admin.ch).

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Sensory analysis is a preliminary simple evaluation which can easily be performed at the enterprise for each food fraction.

Bee concerns and research well established with the public

In 2007 the 100th anniversary of bee research was celebrated with a symposium on the current state of apiary and honeybee research, held in Berne's Kulturkasino and attended by around 500 (Festschrift ALP forum 2007 No. 46). The industry, and hence the past 4 years' research, have been badly affected by unusual overwintering losses, known in the USA as CCD (Colony Collapse Disorder). This phenomenon continues to perplex and has met with a great public response. In 2007 alone our Bee Research Centre (ZBF) was quoted around 270 times in the media.

Sunflower fields do not influence the health of bee colonies.

Professionalization of beekeeping

Because of the strong media presence, concerns relating to bees and beekeeping were picked up by politicians and appropriate departments. Study groups were set up and radical changes in industry structure are planned.

Effective bee research

The ZBF coordinates the worldwide platform on colony loss problems in the "COLOSS" project (Prevention of Honeybee Colony Loss), part of which can be funded as a COST project. A "Bee Virus" project on the behaviour of infected winter bees was started with third party funding. Trials are underway on the lifespan of winter bees under differing pressure from varroa and viruses. A "pathogenic microorganisms and colony death" project was formulated and its funding secured. Clarification on the effects of sunflower fields on bee colony health meant that this special case could be given the all-clear. Around twelve other possible factors or co-factors for bee loss were discussed, refuted or included in the series of principal and secondary causes to be examined within the scope of COLOSS. It proved possible to increase research capacity for this in the short term.

Control of current brood diseases

European foul brood disease, previously under control, has now reached epidemic proportions. Our research laboratories succeeded in developing innovative instruments for diagnosis, early detection and environmental monitoring based on molecular genetic analysis. The international research community rated this breakthrough highly and field trials were very promising. In parallel, as part of a dissertation, a similar stage of development was also reached in the case of the dreaded American foulbrood.

AVB (Liebefeld Alternative Varroa Control) refined as a basis for sustainable beekeeping

Varroa control continues to be beekeeping's greatest challenge. The refinement of AVB was geared to improving efficiency and simplifying procedures, priority being given to oxalic acid aerosols and new vaporisation techniques. Applied research will still be required here in future, until perhaps the natural resistance of our bees can be boosted by breeding efforts in the long term.

Sustainable control of new pests: one example

The "small hive beetle", a native of South Africa, is expanding its biotope. Despite the import ban on bees, it is to be expected that in the years ahead the pest will attack and decimate bee colonies in Europe. Intensive joint efforts are under way with international partners to devise a control strategy which satisfies the concerns of sustainability and the production of high quality honeybee products. Field work on diagnosis and control has been carried out in the USA, with two doctoral and diploma theses having successfully been completed in each case. A further diploma and doctoral thesis on each is currently being co-financed by third party funding.

Basis for recognition of the health-promoting qualities of honeybee products

Our Review "Honey for Nutrition and Health" met with a great international response. At home knowledge on apitherapy was summarised in an ALP forum (2006, 41) and presented to the public at a congress in Berne. The Swiss Apitherapy Association was founded as a contact for researchers as well as for authorities and departments.

ALP wants a sustained combat against the "small hive beetle".

Honey quality and authenticity

Honey came under fire because of residues. The industry reacted, and in 2006, together with the ZBF, devised a comprehensive quality programme covering beekeeping practice, honey extraction and marketing. ALP supports the programme with training courses and product testing. In this context a very effective method of testing honey with infrared spectroscopy was developed within the framework of a dissertation and was implemented by the ALP laboratories.

Efficient up-to-date knowledge transfer

Since 2006 our most important communicators of knowledge– consultants, beekeepers' representatives and cantonal inspectors – have been able to order course documentation (lectures and teaching material) direct from the Member section of our homepage for use in their own courses.

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Our Key Figures 2004-2007

		2004	2005	2006	2007
Financials (as cost-performance accounting in CHF)					
Staff expenses		25'888'430	25'153'853	25'020'377	26'052'461
Expenditure on materials		7'576'423	7'899'445	7'359'775	6'020'743
Investments		1'908'192	1'994'163	1'431'173	866'227
Expenditure		35'373'045	35'047'461	33'811'325	32'939'431
Receipts		5'216'205	4'694'407	4'341'791	4'137'957
Net financial requirement		30'156'840	30'353'054	29'469'534	28'801'474
Staff					
Full time positions	FTE[1]	178.7	183.6	184.1	177.2
Percentage of women	%	28.1	31.4	35.5	35.9
Apprentices and trainees	FTE[1]	29.0	27.0	26.0	24.0
Percentage of university graduates	%	48.6	45.9	48.1	45.5
Percentage of externally funded staff	FTE[1]	14.4	14.2	13.2	14.0
Knowledge and technology transfer					
Publications		452	387	436	465
Presentations		416	365	435	421
Lectures at universities and polytechnics		306	210	239	242
Joint projects		57	53	57	91
Consulting information		38	39	66	25
Approvals and expert opinions		501	466	693	487
Demonstrations for customers		8	12	7	8
Cultures sold for fermented milk products	Units	101'616	95'247	96'600	98'900
Feed inspection		1'695	1'754	1'970	1'597
Inspections		646	586	490	558

[1]Converted in full-time jobs

ALP strives to achieve high quality working methods and works to international Standards:
ISO 9001:2000 Certification and ISO/IEC 17025:2005 Accreditation.

Preview of 2008-2011 Performance Contract

The current Performance Contract was preceded by careful planning. On the basis of the 2008-2011 Agroscope Research Concept, ALP formulated a vision, a product-market strategy, a performance-action model and finally the projects. Interested groups were included at every stage. This meant building on research interests expressed by clients, partners and colleagues as well as on proposals from the Peer Review Report and the Agroscope client satisfaction survey.

Through its research, advisory and implementation activities ALP is helping to ensure that the production of milk, meat and honey remains a strong, central pillar of Swiss agriculture. It promotes consumer confidence in Swiss foods of animal origin, improves image and boosts competitiveness.
ALP is basically continuing the course steered by the 2004-2007 Performance Contract. Intensified activity is anticipated in the nutritional sphere, in competitiveness/economics and in food safety.

In order to forge even stronger links between projects and ALP clients and partners, Forums were created in addition to the Accompanying Expert Group. The red line (meat), the white line (milk), honey bee research and the "NutriScope" research programme each has a Forum. This better combines similar ALP interest groups and takes even better account of the approach to the food chain and value creation chain.

Communication of the results of ALP activities to clients and partners occupies a central role in the new Performance Contract, as do knowledge exchange and networking. A special highlight is the international "Cheese Symposium", organised by ALP and held in Berne in March 2008 with great success.

Agroscope Research Programmes
As part of the 2008–2011 Work Programme Agroscope made a successful start on research programmes overarching the three Research Stations. These are "ProfiCrops", on safeguarding the future of Swiss crop cultivation under largely liberalised market conditions, "AgriMontana", on the contribution of agriculture to the sustainable development of mountain areas and "NutriScope", on product quality and safety, health and nutrition. The programmes investigate questions of current social importance which can only be answered in an inter-disciplinary and trans-disciplinary research alliance.

ALP is responsible for the "NutriScope" research programme. Partnerships have already been arranged with various institutions. The home page www.nutriscope.ch provides up-to-date information on the state of work.

ALP is responsible for the new research programme "NutriScope" for product quality and safety, health and nutrition.

ALP's four main directions of thrust in the 2008-2011 Performance Contract

- Together with its research partners ALP is positioned relative to the qualitative properties of milk, meat and honey bee products. Through scientific studies ALP also makes a key contribution to healthy, safe, high quality foods.
- The new technologies/recommendations formulated by ALP are economically viable (feasibility studies). This improves acceptance by those in the field and secures a competitive advantage for Switzerland as a location.
- Environmentally friendly production compatible with animal welfare and high product quality, soundly based on nutrition and hygiene. ALP is rapidly becoming the national platform.
- Sustainable, extensive production and processing systems for marginal regions help safeguard the income of their populations and make Switzerland into an attractive recreational area for tourists.

Current ALP Projects

Milk and Meat Production

- Dairy cow nutrition and feed evaluation
- Milk quality
- Beef production
- Pig feeding and pork quality

Milk and Meat Processing

- Cheese quality
- New cultures
- Economic assessment
- Application in practice
- Milk processing
- Meat processing

Safety and Quality

- Official animal feed inspection
- Bases for enforcement support & National Reference Laboratory
- Bee Research Centre
- Quality support