Danish Research Centre for Organic Farming

Final Report

For DARCOF II research projects financed by grants from
The Directorate for Food, Fisheries and Agro Business
under the Danish Ministry of Food, Agriculture and Fisheries

1. Research program

Research in organic farming 2000-2005 (DARCOF II)

2. Project title and number

II.5 Use of antimicrobials and occurrence of resistance in organic cattle herds

3. Head of project

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4. Participating institutes

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Den Kgl. Veterinær- og Landbohøjskole
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Slutrapporten sendes elektronisk til Forskningscenter for Økologisk Jordbrug *foejo@agrsci.dk* senest 3 måneder efter projektets afslutning.

Slutrapporten vedlægges et dansk resumé.

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5. Other project staff

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6. Project period (month, year)

Start of project:	2000
End of project:	12, 2004

7. Final report

A. Project summary

Methods to perform a continuous surveillance for antimicrobial resistance at herd level were evaluated and used to compare the occurrence of resistance between organic and conventional dairy herds. In addition the treatment patterns of animals in organic herds with different level of antibiotic usage were studied.

The project consisted of four work packages

WP1 Monitoring of use of medicine

Establishing of a registration and reporting procedure on the use of drugs for individual animals. Clinical mastitis was described using a protocol which was developed by the research group in another project.

WP2 Occurrence and dynamics of antimicrobial resistance in dairy herds

Antimicrobial resistance of commensal *E. coli* was accessed in five herds by isolates from fecal samples of randomly selected animals in two groups: calves up to 6 month old and cows. Samples were taken four times the first year of the study to evaluate the dynamics on herd level and in relation to season.

Data was analysed together with results from ongoing projects from another 20 organic and 20 conventional herds to describe the pattern and dynamics of resistance and develop a scheme for monitoring of antimicrobial resistance on herd level.

WP3 Characterization of treatments in organic farms

Systematic clinical registrations of udder health of cows with and without veterinary treatment were implemented on a monthly basis in five herds, to provide data on treatment strategy and outcome of antibiotic treatments.

Herd managers were interviewed on treatment routines using qualitative research interviews.

Data was analysed using method triangulation based on grounded theory analysis.

Results of these analyses were combined with analysis of data on somatic cell counts and milk production.

WP4 Use of herd specific plans for control of antibiotic resistance

Herds with a very low use of antibiotics and/or a good herd health were included to describe the strategies for health management and disease handling in the herds. The general principles for handling disease and health management were described. Possibilities of managing health without antibiotics were described.

Table A.1: Work package list (from application)

Work-package No	Work package title	Participants*	Budget	Start	End	Deliverable No
1	Monitoring of use of medicine	SMT, KVL TWB, MV	245	1	33	1
2	Occurrence and dynamics of antimicrobial resistance in dairy herds	FAA, DFVF, TWB, KVL	868	12	39	3, 6, 8
3	Characterization of treatments in organic farms	MV, DJF, TWB, SMT, KVL	314	7	39	5, 9
4	Use of herd specific plans for con-	SMT, KVL,	277	10	39	9, 10

	trol of antibiotic resistance	TWB, MV				

* Responsible participants are underlined

B. Objectives and expected achievements

- To determine potential differences in the occurrence of antimicrobial resistance between conventional and organic dairy farms
- To investigate the possibility to perform a continuous monitoring of antimicrobial resistance by evaluating the dynamics of antimicrobial resistance.
- To characterize the treatment pattern of organic herds and based on this, develop guidelines for disease treatment which fits the goals for the organic herd, meet the demand for animal welfare and minimise the risk for antimicrobial resistance.

C. Progress and results

C.1 Description (summary) of main results and conclusions

WP1 Monitoring of use of medicine
A continuous monitoring of medicine usage has been carried out in the first five herds in the project and for a shorter period in the 10 herds in WP4.

WP2 Occurrence and dynamics of antimicrobial resistance in dairy herds
Analysis of data on antimicrobial resistance of commensal E. coli shows that the prevalence of antimicrobial resistance is related to age in the 60 herds examined. Table 1 shows the results of the initial analysis for calves up to 23 weeks old. The prevalence of antimicrobial resistance was found to be very low (<5%) among cows in both organic and conventional herds. The sampling scheme was changed in the first 5 herds based on these findings to sample the same calves at 3 months intervals. The analysis of these samples confirmed the finding that the prevalence of antimicrobial resistance decreases with age. Highest level of resistance is found 1 week after birth. However, the trend of decreasing resistance is broken at the age of 3-4 month. These findings might be related to treatments for diarrhoea and pneumonia respectively. The results were submitted for publication, the paper is under revision at the moment.The relation between treatment of individual animals and occurrence of resistance has been analyzed, but no signficantrelation has been found in the dataset. No systematic change in resistance related to season was found.

Table 1. Predicted proportion of isolates resistant to streptomycin, sulphamethoxazole, ampicillin, tetracycline, trimetoprim, chloramphenicol and nalidixic acid for calves 9, 60 and 180 days old and to streptomycin, sulphamethoxazole, ampicillin and tetracycline for cows. Predictions for calves based on model of 949 Danish isolates of *E. coli* from 58 herds. Details are published in Bennedsgaard (2003).

Age of animal	Antimicrobial agent*						
Calves 9 days	STR	SMX	AMP	TET	TMP	CHL	NAL
Conventional	0.69[a,b]	0.71[a,b]	0.47	0.52	0.47	0.20	0.17
Old organic	0.64[b]	0.61[b]	0.47	0.55	0.29	0.24	0.11
Converting herds before conversion	0.78[a]	0.77[a]	0.58	0.69	0.43	0.22	0.14
Converting herds two	0.69[a,]	0.68[a,]	0.61	0.69	0.37	0.21	0.11

years after conversion	b	b					
Calves 60 days old							
Conventional	0.25	0.21	0.07	0.06	0.10	0.01	0.00
Old organic	0.20	0.15	0.07	0.07	0.05	0.01	0.00
Converting herds before conversion	0.35	0.27	0.11	0.12	0.09	0.01	0.00
Converting herds two years after conversion	0.27	0.20	0.12	0.12	0.07	0.02	0.00
Calves 180 days old							
Conventional	0.02	0.02	0.00	0.00	0.00	0.01	0.00
Old organic	0.02	0.01	0.00	0.00	0.00	0.01	0.00
Converting herds before conversion	0.03	0.03	0.00	0.01	0.00	0.01	0.01
Converting herds two years after conversion	0.02	0.02	0.00	0.01	0.00	0.01	0.00
Cows							
Conventional	0.04	0.02	0.03	0.04			
Old organic	0.03	0.01	0.01	0.01			
Converting herds before conversion	0.02	0.06	0.02	0.01			
Converting herds two years after conversion	0.03	0.03	0.03	0.01			

*STR=streptomycin, SMX=sulphamethoxazole, TET=tetracycline,
AMP=ampicillin, TMP=trimetoprim, CHL= chloramphenicol, NAL=nalidixic acid.

Based on the results it can not be recommended to use *E. coli* as indicator for antibiotic resistance of adult cattle in individual dairy herds. Sampling of calves can be used if the number of animals sampled is relatively large and correction for age is made. However, further investigations into the reasons for herd differences are needed.

WP3 Characterization of treatments in organic farms

The initial interviews were carried out in November-December 2001 based on key figures from herd data and a step-wise identification of treatment criteria on four different levels (symptom level, cow level, and the levels of the herd situation and perception of alternatives, respectively, identified through previous study. (Vaarst et al. 2002).

Based on this, expectations and wishes connected to a more explicit future treatment pattern were discussed with the farmer and in most herds the veterinarian on herd visits in February 2002 in five herds.

An initial model for description of success of treatment and graphical presentations of data on udder health and use of veterinary medicine has been developed. These tools was used and evaluated in the discussion of future treatment strategies in the selected herds.

The data shows a considerable variation in the amount and types of antibiotics used in the herds (table 2 and 3). Based on the discussion with the farmers and veterinarians on herd visits the differences seem to relate more to preferences of the veterinarian than to herd specific factors.

The average number of days of treatment with antibiotics in case of mastitis decreased in most herds after conversion to organic production in June 1999 (table 2).

Table 2. Mean number of days pr mastitis treatment, five herds.
Data from 1998 to 2002.

Year after conversion	mean	minimum	maximum
-1	2,2	1,0	3,0
1	1,4	1,0	2,0
2	1,5	1,0	2,0
3	1,6	1,1	2,7

Table 3. Use of antibiotics for mastitis treatment in five herds in 2001.
Percent of treatments with different groups of antibiotics

Antibiotics	Mean (%)	Min	Max
Narrow-spectrum penicillins	29	11	41
Narrow-spectrum penicillins and streptomycin	9	0	29
Broad-spectrum penicillins[2]	24	17	26
Cephalosporins	17	1	29
Macrolides	4	1	9
Sulfonamides/trimetoprim	4	0	13
Tetracyclines	6	0	23

[2] Ampicillin, amoxicillin, cloxacillin

A description of the choice of antibiotics and duration of antibiotic treatments based on data from this study and a parallel study are included in Bennedsgaard, 2003. The study concluded that the average length of treatment decreased significantly after conversion in herds that had access to follow up treatments by the farmer (herds with an official herd health contract) before conversion. Conventional herds without access to follow up treatment did not differ from organic herds with regard to treatment length. It was also found that organic herds differed in the choice of products for intramammary application. In the organic herds products with the shortest withdrawal time of milk were more commonly used.

WP4 Use of herd specific plans for control of antibiotic resistance

Only minor changes in the use of antibiotics were seen in the five herds involved in WP3 in the first year of the study. One of the obstacles to reducing the use of antibiotics seemed to be the lack of experience with handling of infection without antibiotics among both farmers and veterinarians. To describe strategies for reduced use of antibiotics WP4 was changed to include six farms that already had a very low antibotic usage and six herds that said they were in the process of reducing antibiotic usage.

The strategies used in the two herds groups were accessed by semistructured qualitative interviews. Most farmers emphasized that the low use of antibiotics was the result of a gradual process including preventive measures and changing criterias for selection of cows for treatment (Vaarst et al (n prep)). All farmers emphasized that they would still use antibiotics in certain cases where they found that the animal's welfare was threatened.

When analysing data from 2003 (one year before the interviews) and 2004 it can be seen that the herds with very low antibiotic usage continued to have a low antibiotic usage. In the herds planning to reduce the use of antibiotics a decline in the usage can be seen, however, due to a large variation and only six herds the change is not statistically significant. In 2004 the level of antibiotic mastitis treatment where about half the level in the 77 herds used for comparison (Table 4).

The process of reducing the use of antibiotics based on the farmers experiences might be a long term stable result, however since the farmers only found very limited support from their veterinarian other tools for facilitating the phasing out of antibiotics might be useful.

Table 4. Udder health data on six herds with very low antibiotica usage, six herds working on phasing out antibiotic usage and 77 organic dairy herds not involved in the research project.

Group	No herds	Mastitis treatments pr 100 cowyears	Calculated Bulk tank SCC	Herd size (cowyears)	% cows with chronicSCC at test day	% cows with acutely elevated cell-coun per month	Culling rate/ year
Low AB 2003	6	3 (0-5)	324 (180-550)	75 (29-142)	14 (2-40)	3 (1-4)	29
Low AB 2004	6	0 (0-1)	281 (144-479)	77 (2-39)	22 (1-5)	4	35
Phasing out AB 2003	6	37 (22-55)	221 (140-260)	90 (56-125)	14 (3-15)	3 (1-3)	31
Phasing out AB 2004	6	26 (7-58)	214 (180-220)	87	15 (9-18)	3 (1-4)	39
Other organic herds 2003	77	43	298	105			34

Numbers in parenthesis are min-max values

WP1 Monitoring of use of medicine	Time schedule according to application	Deviations, if any*
Deliverables		
Data on disease, use of medicine and clinical cases of mastitis	Continuous	no
Milestones		
M3 Establishment of a system for registration of use of drugs and disease in herds	May 2000	no
M4 Introduction of registration of clinical mastitis	Feb 2002	March 2002
M13 Termination of data collection	June 2003	May 2004

WP2 Occurrence and dynamics of antimicrobial resistance in dairy herds	Time schedule according to application	Deviations, if any*
Deliverables		
3. Determination of the difference in the occurrence of antimicrobial resistance in conventional and organic dairy herds. (Pu)	June 2002	March 2003
6. Description of the dynamics of antimicrobial resistance over time. (Pu) (one publicatioin with D3)	July 2002	March 2003
8. Description of changes in disease incidence and antimicrobial resistance after conversion to organic farming. (Pu)	July 2003	March 2003
Milestones		
M1 Determination of the difference in the occurrence of antimicrobial resistance in conventional and new and old organic dairy herds.	Sept 2001	March 2003
M10 Description of the dynamics of antimicrobial resistance over time	July 2002	March 2003

M12 Collection of fecal samples	June2002 – March 2003	August 2002-June 2003 No collection in June 2003
M14 Evaluation of changes in antimicrobial resistance from conversion until 3½ years after conversion to organic farming.	July 2003	Not carried out

WP 3, Characterization of treatments in organic farms	Time schedule according to application	Deviations, if any*
Deliverables		
1 Description of the combination of qualitative studies of treatment choices and quantitative data (pu.)	June 2002	November 2002 (first publication June 2002)
9 Recommendations for treatment strategies in organic dairy herds (Danish Report)	October 2003	July 2004
Milestones		
M1: Selection of herds and implementation of clinical examinations	Nov. 2001	March 2002
M7: Qualitative analysis on herd level of treatment patterns carried out	Feb. 2002	May 2002
M9: Analysis of data from 5 herds (in depth studies) and 40-45 herds (overall level; standardised health and production recordings)	June 2002	December 2004 (6+6+77 herds)
M15: Recommendations (Danish Report)	October 2003	Gen. recommandations and brochure December 2004

WP 4, Use of herd specific plans for control of antibiotic resistance	Time schedule according to application	Deviations, if any*
Deliverables		
9. Recommendations for treatment strategies in organic dairy herds (Danish Report)	October 2003	Gen. recommandations and brochure December 2004
10. Description of the effect of change in treatment strategies on the occurrence of anti-microbial resistance Changed to: Description of differences in use of antimicrobials and occurrence of antimicrobial resistance.	October 2003	April 2003 (based on *S. aureus* milk samples)
Milestones		
M2 Selection of herds and determination of initial occurrence of anti-microbial resistance	Nov. 2001	Nov. 2001
M6 Preparation of herd specific plans	Dec. 2001	Feb-Nov. 2002
M8 Midway evaluation and correction of plans	May 2002	Dec. 2002
M11 Final evaluation of plans and status of occurrence of anti-microbial resistance.	April 2003	Not carried out
M15 Recommendations (Danish report) including results from WP3	October 2003	Gen. recommandations and brochure December 2004
M17 Analysis of change in antibiotic resistance and changes in use of medicine	October 2003	July 2004 (only use of medicine)

** Deviations are to be further discussed in D*

D. Description of deviations and subsequent adjustments of plans

There has been some delay in the plans, due to the fact that all contact to herds has been impossible during the last part of the housing period 2001 (early March-June) because of restrictions in connection with the outbreak of foot & mouth disease. The selection of herds and introduction of registrations has there fore been postponed to the late autumn 2001.
Data on medicine use and resistance in conventional and old organic herds has been delayed because of extensive work on validation of data from the central databases.

The initial sampling of fecal samples showed a very low prevalence of resistance in samples from cows, where as calves samples showed a high level of antimicrobial resistance in very young calves (1-3 month) and less in older calves. Based on these findings the sample plan for fecal samples has been changed to sampling of only 20 calves from 0-6 month of age including calves sampled at the previous visit.

One of the five herds in wp2+3 has dropped out of the study because of return to conventional production. The herd was not substituted by another herd.

Only minor changes in the use of antibiotics were seen in the five herds involved in WP3 in the first year of the study. One of the obstacles to reducing the use of antibiotics seemed to be the lack of experience with handling of infection without antibiotics among both farmers and veterinarians. Based on this it is unlikely that any major changes will take place with regards to antibiotic resistance.

Based on this experience the selection of herds for WP4 has been changed. Six herds that have used none or only very small amounts of antibiotics was selected in June 2003 together with six herds with good health status and interest in reducing the use of antibiotics. The aim of inclusion of these herds was to describe the challenges in adopting the experiences from herds with very low or no use of antibiotics in motivated herds with a good herd health. Data from the herds from 2003 and 2004 have been evaluated.

The change in the selection of the herds has resulted in a delay of the project. The collection of data ended in June 2004

Thorkild Nissen from Økologiens Hus has been involved in the work in WP4 financed by Økologien Hus.

Because of the lack of differences in antibiotic resistance of *E. coli* between the herd groups and the strong relation between age of the animal and prevalence of resistant *E. coli* it was decided to access the level of antibiotic resistance in the 10 new herds by isolation of *S. aureus* milk samples.

The results of WP3 and WP4 showed that the farms developed a herd specific strategy based on their own experiences in a process taken several years. The knowledge collected in the project did not allow setting up simple guidelines for reduction of antibiotic usage. Because of that the planned report on treatment guidelines has not been written. In stead the research group has participated in the production of two written materials.
-A folder describing the experiences of the 12 farmers participating in WP4 produced by Økologisk landsforening with support from "Fonden for økologisk landbrug" and "Dyrenes beskyttelse".
- A white paper on good practice on use of milk samples in handling and prevention of mastitis made as statement for the Danish veterinary authorities and presented for cattle veterinarians at

several symposiums.

E. Project publications and other products

[Produkter under 1 skal kopieres fra Organic Eprints. Dette gælder også for produkter, som kun delvist er finansieret af FØJO. Listen fra Organic Eprints kan findes på hjemmesiden http://www.okoforsk.dk/projekt/index.html under "Project publications" på de enkelte projekter.]

[Produkter under 2 er mundtlige præsentationer og andet, som ikke skal kunne findes i Organic Eprints]

1. Products from Organic Eprints archive

Peer-reviewed and accepted

English

Vaarst, Mette; Thamsborg, Stig Milan; Bennedsgaard, Torben Werner; Houe, Hans; Enevoldsen, Carsten; Aarestrup, Frank Møller and Snoo, Arno de (2003) Organic dairy farmers decision making in the first 2 years after conversion in relation to mastitis treatment. *Livestock Production Science* 80(1-2):pp. 109-120.*

Submitted for peer-review but not yet accepted

English

Bennedsgaard, Torben Werner; Thamsborg, Stig Milan; Aarestrup, Frank Møller; Enevoldsen, Carsten and Vaarst, Mette (2003) Antibiotic resistance of Escherichia coli in conventional and organic dairy herds in Denmark. [preprint]*

Bennedsgaard, Torben Werner; Thamsborg, Stig Milan; Aarestrup, Frank Møller; Enevoldsen, Carsten; Vaarst, Mette and Christoffersen, Anna Bodil (2003) Resistance of Staphylococcus aureus isolates from cows with high somatic cell counts in organic and conventional dairy herds in Denmark. [preprint]**

Bennedsgaard, Torben Werner; Thamsborg, Stig Milan; Aarestrup, Frank Møller; Enevoldsen, Carsten; Vaarst, Mette and Larsen, Per Bundgaard (2003) Use of veterinary drugs in organic and conventional dairy herds in Denmark with emphasis on mastitis treatment. [preprint]*

Not peer-reviewed

English

Vaarst, Mette; Bennedsgaard, Torben Werner; Klaas, Ilka; Nissen, Thorkild Bülow; Thamsborg, Stig Milan and Østergaard, Søren (2005) Development and daily management of an explicit non-antimicrobial-use policy in 12 Danish organic dairy herds. Working Paper, Dept Animal health, Welfare and Nutrition, Danish Institute of Agricultural Science.

Dansk - Danish

Aarestrup, Frank Møller; Bennedsgaard, Torben Werner; Enevoldsen, Carsten; Houe, Hans; Katholm, Jørgen; Larsen, Helle Daugaard; Nylin, Britta and Pedersen, Lars Holst (2004) Analyse af mælkeprøver i pilotprojekt NYSundhedsrådgivning. Report.**

2. **Other products (oral presentations, public meetings, field days, etc.)**

"Reduced use of veterinary drugs in organic dairy herds – potentials and consequences", Midterm seminar for ph.d. student Torben Werner Bennedsgaard, October 1, 2001, KVL *

Vaarst, M. 2002. Strategi i stedet for antibiotika [Strategy instead of antibiotics. In Danish]. Økologisk Jordbrug, 14. Juni 2002, s. 11.

Nissen, T. B & Vaarst, M.. 2003. Kovelfærd uden antibiotika [Cow welfare without antibiotics] Økologisk Jordbrug 26. december 2003

Nielsen, K.M. Mange yverbetændelser er forudsigelige. [Many mastitis cases are predictable. In Danish]. Økologisk Jordbrug, 14. Juni 2002, s. 11.

Bennedsgaard, T. W. "Mastitis treatment, success or failure" Presentation at meeting for farmers and veterinarians, The Danish Dairy Board, Rødding, 30. January 2002.*

Bennedsgaard, T. W.. 2003. "Reduced use of veterinary drugs in organic dairy herds – potentials and consequences". Ph.D. dissertation, The Royal Veterinary and Agricultural University, Frederiksberg, Denmark. *

* 25-75% financed by DARCOF
** 5-25% financed by DARCOF

F. Scientific education

Elements of the project are part of Torben Werner Bennedsgaards ph. d. study.

Arno de Snoo, Scottish Agricultural College, completed a Master thesis within the project with Mette Vaarst as supervisor during two stays (4½ months in total) in 2002 at Danish Institute of Agricultural Sciences, Department of Animal Health and Welfare. Master thesis: Farming styles in Danish organic dairy farming and the relations to health strategies with an emphasis on mastitis treatments. DIAS, pp. 89.

G. National and international cooperation

Research stay at Professor Paul Bartlett, Michigan State University by Torben Werner Bennedsgaard March-April 2001.

Thorkild Nissen, Økologiens Hus (WP4)

H. Critical reflection on the project

The monitoring of antimicrobial resistance has been successful giving new information on the dynamics of resistance of commensal E. coli on herd level and in relation to age of dairy calves. The ability to change in sampling scheme has given a data set which is better suited for describing

the marked variation in prevalence of resistance with age. However, to describe the level of resistance in a given herd a sampling scheme in which a few calves at a given age (2-3 weeks old would be optimal) were sampled would give a more comparable picture. Such a sampling scheme is not easy to implement in the actual research project since it would required a largely increased number of herd visits which should be planed after the birth of calves in the single herd. The budget of the project does not allow such a change.
The rapid decrease in prevalence of antimicrobial resistance means that only a limited number of animals can be used in the analysis of relations between antibiotic treatment and antimicrobial resistance.
Based on interviews with farmers and results from another project isolation of *S. aureus* from milk samples was used in the last part of the project. Penicillin resistance of *S. aureus* may have impact of the choice of antibiotics for mastitis treatment, the disease that accounts for the largest part of the use of antibiotics in dairy herds. However, *S. aureus* might be regarded as a long term indicator of antibiotic resistance since a strain introduced or developed in the herd will infect several cow by horinzontal transmission. A high prevalence of penicillin resistant isolates might therefore represent a high risk of transmission and not a high selective pressure from antibiotics. Analysis of milk samples must therefore be seen as a tool for optimizing the preventive strategies of the herds more than a tool for comparing prevalence of antibiotic resistance between herds.

The initial meetings with farmers and veterinarians gave important knowledge about the different roles in the decision process before eventual antibiotic treatment.

The combination of research methodology (quantitative and qualitative) and the use of participatory methods are very depending on the collaboration between researches, an well-described distribution of tasks and responsibilities, and a group of farmers and veterinarians, who contribute to the project in a way which is beneficial for the project.

The risk of development of antimicrobial resistance is normally not a subject in this decision process, and the research group places an important role in the introduction of this new problem to the process. The changed design of WP4 meant that the information collected was only affected by the researchers to a limited extent. However, the process of phasing out of antibiotics was described by the words of the farmer retrospectively. This might have affected the results, since the farmers interviewed with low antibiotic usage were a selected group that had actually succeedded in reducing the use of antibiotics.

During the last year of the project part of the project group have been involved in another research project based on the preliminary results of this project. In this project the farmers are all delivering milk to the same dairy, which have a formulated strategy of being able to deliver milk from cows not treated with antibiotics. The farmers are working together in groups with 4-6 farmers in "barn schools". These schools consist of meetings in the farmers' herds where the main challenges for improving udder health and reducing the use of antibiotics are discussed with the other farmers. This approach has the advantage that experiences are spread among farmers quickly and the farmers do not depend on having a veterinarian interested in his strategy.

Prevention is definitely the most important part of redusing the use of antibiotics. However, in the case of infectious diseases the farmers use different alternative strategies like frequent striping, nursing cows and homeopathy. None of these strategies are scientifically tested. Further research should focus on collecting more information about the processes enabling farmers to reduce the need for antibiotics but also on documenting potentials and consequences of using non-antibiotic treatments and procedures.

8. Budget

A. Account for any change in budgets

Due to the delays in the consumption in 2001 and 2002 have been reduced and the budget for 2003 increased and the project period extended to 2004 for KVL.
For KVL the original budget are the revised overall budget as approved by DFFE, August 2003 (J. nr. 3501-62-03-80). This change are included in the overall budget.

B. Budget for the whole project (1.000 DKK)

Year:	Original budget	Consumption before 2003	Consumption 2003	Consumption 2004	Total
Man-months					
Scientific personnel	16.2	9.8	1.8	3.5	15.1
Technical personnel	23.2	13.5	16.5	0	30

Year:	Original budget	Consumption before 2003	Consumption 2003	Consumption 2004	Total
Salaries					
Scientific personnel	612.5	343.5	70.0	130.0	543.5
Technical personnel	495.0	241.4	309.8	0	551.2
Other operational costs	185.0	102.0	91.0	0	193.0
Equipment	0	0	0	0	0
Others (please specify) (tra. el KVL)	40.0	16.	16.0	12.0	44.0
Direct costs	1332.5	702.911		142.0	1331.7
Indirect costs (20% of direct costs)	266.5	140.6	97.4	28.0	265.9
Total	1599.0	843.5	585.2	170.0	1.597.7

Comments:

9. Signatures and stamps

Name	Institute	Date	Signature
Head of project Frank M. Aarestrup	Danish Institute for Food and Veterinary Research		

Appendix I. Detailed budget

A. Budget for each participating institute (1.000 DKr)

Name of Institute: Kgl. Veterinær og Landbohøjskole

Year:	Original budget	Consumption before 2003	Consumption 2003	Consumption 2004	Total
Man-months					
Scientific personnel	9.25	5.5	0.25	3.5	9.25
Technical personnel	5.2		4.5	0	4.5

Year:	Original Budget*	Consumption before 2003	Consumption 2003	Consumption 2004	Total
Salaries					
Scientific personnel	339.0	187.0	13.0	130	330
Technical personnel	100	0	100	0	100
Other operational costs	45	22	31	0	53
Equipment					
Others (please specify)	40	16	16	12	44
Direct costs	524	225	162	142	527
Indirect costs (20% of direct costs)	105	45	32	28	105
Total	629	270	193	170	632

Comments:
other costs are travel expenses
Due to the delays in the consumption in 2001 and 2002 have been reduced and the budget for 2003 increased and the project period extended to 2004.
*Revised overall budget as approved by DFFE, August 2003 (J. nr. 3501-62-03-80)

B. Budget for each participating department (1.000 DKK)

Name of Institute and department: Danmarks Jordbrugsforskning

Year:	Original budget	Consumption before 2003	Consumption 2003	Consumption 2004	Total
Man-months Scientific personnel Technical personnel		4.25	1.5		5.75

Year:	Original budget	Consumption before 2003	Consumption 2003	Consumption 2004	Total
Salaries Scientific personnel Technical personnel	213.5	156.5	57		213.5
Other operational costs	40	30	10		40
Equipment					
Others (please specify)					
Direct costs	253.5	186.5	67		253.5
Indirect costs (20% of direct costs)	50.7	37.3	13.4		50.7
Total	304.2	223.8	80.4		304.2

Comments:

C. Budget for co-financing from each participating institute (1.000 DKK)

Name of Institute: Danmarks Fødevareforskning

Year:	Original budget	Consumption before 2003	Consumption 2003	Consumption 2004	Total
Man-months					
Scientific personnel	1.2				
Technical personnel	18	13.5	12		25.5

Year:	Original budget	Consumption before 2003	Consumption 2003	Consump-tion 2004	Total
Salaries					
Scientific personnel	60				
Technical personnel	395	241.4	209.8		451.2
Other operational costs	100	50.0	50.0		100.0
Equipment					
Others (please specify)					
Direct costs	555	291.4	259.8		551.2
Indirect costs (20% of direct costs)	111	58.3	52.0		110.3
Total	666	349.7	311.8		661.5

Comments: