Danish Research Centre for
Organic Food and Farming

Progress Report 2007 and Application for Continuation in 2008

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1. Project title and acronym

Organic Milk of High Quality – Development of Production Concepts Based on grazing of the Dairy Cows and Gentle Treatment of the Milk during Handling and Processing

ORMILKQUAL

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2. Project journal number

3304-FOJO-05-38-01

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3. Project period (month, year)

Start of project: 0306
End of project: 0310

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[ændinger i forhold til ansøgningen skal tydeligt fremgå]

7. Midterm description of the project, its results and progress, and application for continuation in 2008

A. Project summary

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

WP No.	WP title	Responsible scientist	Budget DKK	Start	End	Deliverable No.
1.	Grassland and feeding in a farm perspective	Troels Kristensen, JPM		0106	1209	D1.1-D1.5
2.	Milk quality in relation to feeding of the dairy cow with a high level of legumes	Jacob H. Nielsen, ARK		0106	1209	D2.1-D2.6
3.	Modern milking technologies suitability for organic milk production	Lars Wiking, ARK		0106	1208	D3.1-D3.4
4.	Novel and gentle milk treatment for high quality organic milk with improved functionality	Richard Ipsen, DT		0106	1208	D4.1- D4.8
Total						

Objectives and expected achievements

Midterm results and progress

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

[Her skal der kun stå resultater og konklusioner for de enkelte år, men ikke noget om projektets forløb i forhold til planen]

WP1: Grassland and feeding in a farm perspective

Swards with lucerne (*Medicago sativa*), red clover (*Trifolium pratense*), white clover (*Trifolium repens*) and white clover together with chicory (*Cichorium intybus*) were established in 2005 together with perennial ryegrass (*Lolium perenne*). A grazing study was carried out in 2006 over three two-week periods during the season (May, June and August) with identical herbage allowance by adjustment of the area before start of the grazing period. In addition was the effect of the same types of herbage as silage supplemented with concentrates and maize silage (12.2 kg DM) examined during one two-week period in the following winter using 4 times 12 Holstein Frisian cows in both experiments.

Registrations were made on herd and sward productivity, herbage quality, botanical composition and intake during grazing with special attention to selection. Sward height was determined before and after each grazing period by 50 and 100 measurement, respectively, using a rising-plate meter. Sward productivity was estimated indirectly in an area fenced off during the period. At start and after one week of grazing the herbage mass and the botanical composition were determined in 0.5 m^2 samples in the grazed area and in the fenced area. Milk yield was recorded individually, and milk samples for analysis of composition were collected, over one day three times during each feeding period. Bulk milk was sampled three times at day 7, 11 and 14 for sensory tests.

Results
The proportion of legumes and chicory was high in the four species mixtures. Sward composition highly affected grazing behaviour. Sward height measurements indicate that the white clover mixture was eaten without much selection, the red clover was partly avoided in some areas, and in contrast

lucerne seemed to be eaten selectively. In chicory swards selection occurred in a patchy way. The cows, 30.7 +- 5.8 kg energy corrected milk (ECM) and 140+- 68 days in milk at the beginning of the experiments were at pasture for 20 hours daily during the three summer periods. Milk yield was unaffected by treatment and at the same high level in all three periods (Table 1).

Table 1. Composition of the four sward types and the effect on milk production and composition in average of three grazing periods.

	Sward type – main component				
	White clover	Red clover	Lucerne	Chicory	SEM
Sward					
Main component, % of DM	56	52	26	54	
Herbage mass, kg DM ha^{-1}	1458	1823	1729	1411	
Crude protein, % in DM	23.2	24.0	22.0	18.2	
Milk production[1]					
Milk, kg	31,9	31,7	31,0	31,5	0,6
Protein, g	1049	1038	1009	1023	17
Fat, g	1186	1182	1164	1218	29
Milk content					
Protein, %	3.31	3.28	3.28	3.26	0.03
Fat, %	3.78	3.72	3.80	3.90	0.09
Urea, mmol	5.43a	5.50a	5.05a	2.77b	0.16
Somatic cell count, 1000 (log)	4.59	4.69	4.58	4.73	0.13

ab: Different letters indicate significant (P< 0,05). Figures are lsmeans model y=yield at start, parity, days in milk, period and treatment

1: Pasture supplemented with 6,2 kg DM.

The milk protein content was also identical between treatments on average for the three periods, but with a general reduction during the season (data not shown). Milk-urea content was clearly lowest in the milk from the cows grazing chicory irrespectively of period, while the ranking of the other treatments changed during the season, with red clover being highest in the first two periods and white clover in the last period.

The experiment with silage showed that the total DM intake was from 21.9 kg when red clover was used to 27.1 kg DM when lucerne was the silage type given. The protein content in DM for the rations varied from 16.7% in both the white clover and chicory rations to 20.0% in the red clover ration, due to the high content in red clover silage compared to the three other types. The production from the cows (29.8 +- 6.3 kg ECM and 127+- 78 days in milk at start of the experiment) was unaffected by the variation in type of silage. The milk protein content was also identical between treatments, while milk fat content was significantly higher in the milk from the cows fed lucerne than the three other types of roughage. As in the pasture period, milk-urea content was lowest in the milk from the cows given chicory

WP2: Milk quality in relation to feeding of the dairy cow with a high level of legumes

Chemical analysis

The objective of was to establish a relationship between milk quality and dairy cows' feed. Chemical analysis of components in milk and feed as well as sensory analysis of milk will provide the basis to reach this objective. Therefore two tasks will be investigated:

A) Chemical composition of milk and feed. In order to cover the natural individual variations as well as the variations due to sampling period, milk samples and feed will be analyzed over a longer period ranging from spring to summer months and milk samples will be analysed as bulk samples and as individual samples.
B) Correlation of chemical composition with sensory evaluation of bulk milk samples.

WP2 will ultimately yield results that should point out how to produce milk with a composition, nutritional properties and flavour that differ from conventionally produced milk.

In 2006, milk samples originate from the research farm "Rugballegård" as described in WP1

The experimental design at Rugballegård in 2006 comprised 4 sets of 12 cows. Each set was allowed to graze one specific type of pasture (alfalfa, chicory, white clover or red clover) during 3 experimental periods in May, June and August. Milk samples were collected during these 3 periods at three different dates for each month. For each sampling date, the samples were collected as bulk milk and individual milk samples. This means that there are 36 bulk milk samples and 432 individual milk samples to be analyzed. Analyses carried out are fatty acids (GC-FID), E-Vitamin (HPLC), carotenoids (HPLC), volatiles (SPME-GC-MS, only bulk milk) and phytoestrogens (LC-MS). All analyses should be performed in triplicate. All in all this results in 540 analyses of bulk milk samples and 5184 analyses of individual milk samples.
Pasture samples were collected at the beginning of each month. This yielded 24 samples, resulting in a total of 288 analyses (same components as milk but not phytoestrogens).

Analyses have now been carried out, though not on all samples as it was totally unconceivable to run close to 6000 analyses. Most results have now been compiled and will result in two publications before the end of 2007.

Results
After processing the numerous results of the chemical analyses of fatty acids, phytoestrogens and volatiles by PCA it appears that there is an effect on milk components. Indeed it is possible to group the various milks, from the point of view of their chemical components, according to the pasture the cows were allowed to graze.

Fatty acid composition shows that herbage in May contains more unsaturated fatty acids than in August. In May, alfalfa, white clover and in a lesser extend red clover had high levels of linolenic acid, which decreased in august while the saturated palmitic and stearic acids were becoming predominant. This effect can be seen in the fatty acid composition of milk where it is milk collected in May that showed higher levels of unsaturated fatty acids, especially linolenic acid and CLA, and milk collected in August that showed higher levels of saturated fatty acids and concurrently lower levels of unsaturated fatty acids.

Phytoestrogens are not analyzed in herbage as this is not part of the project description. It is therefore not possible to make a direct correlation of phytoestrogen composition in milk and herbage.
Results of phytoestrogen analyses in milk were processed by PCA which shows that milk samples can be grouped according to herbage grazed by the cows, especially red clover which is predominantly characterized by equol, daidzein and formononetin, as well as according to sampling period.

Analyses of volatiles in milk, show that milk samples in May can be grouped according to the herbage grazed. However there is no such significant grouping in August.
Volatile composition in herbage is far more complex with approximately 100 components identified and 20 not identified (in milk the same sampling technique allows identification of only 8-12 components). Performing a PCA of the volatile analyses in herbage allows grouping according to both herbage type as well as month of sampling.

Concentration of carotenoids in milk from cows fed alfalfa pasture was strongly correlated to high content in β-caroten which is expected to act as antioxidant in milk.

As regards E-Vitamin analyses, results are not yet totally processed and therefore will not be discussed at this time.

Sensory experiments
Three different experiments have been conducted during 2006 to evaluate how the level of different legumes and herbs affects the quality of organic milk (described in WP1). Two experiments were conducted during the summer period when cows are at pasture, and one during the winter period. Results from both summer and winter period showed significant differences between feedings. Such differences were different in the different periods. The sensory quality of the milk changed in the different delivery days (sessions). This inconsistency was not due to a bad performance of the panel, as confirmed by the chemical analysis. Milk being different on different delivery days suggested that milk changed very quickly.
Two different experiments have been conducted during 2007. The first experiment was in summer and

the second one in autumn. However, data analysis related to the second experiment is still in progress. The experiment focused on just one variety of milk: white clover. Milk samples from seven different farms were profiled, which were different in race (Holstein-Fries and Jersey), amounts of white clover in the grass field (low-middle-high) and amounts of grass in the feed (33%-35%-60%-70%). Results showed big differences between samples on the attributes “yellowness”, “creaminess” and “fatness”. The differences were due to the different race. Specifically, milk samples from “jersey” cows presented high values on these attributes.

Postponed activities related to the FOEJO II project “Production of organic milk of high quality considering the future demands for use of organically produced feed and natural vitamins (II-2)” are included in the present WP and there has been developed a method to evaluate degradation products of a-tocopherols in milk. For the first time has the quinine of a-tocopherol been identified in foods. Ph.d-student Tina Slots will finish her ph.d-study before April 2008.

WP 3: Effect of grass feeding on enzymes involved in the synthesis of milk fat

Four groups of cows were offered 4 different silage-based diets, red clover, white clover, Lucerne and grass silage, respectively (described in WP 1). After 4 weeks of experimental diet, udder biopsies were taken from 7 cows in each group. The udder tissue sample was extracted and PCR analyses for mRNA for fatty acid synthase, desaturase, acetyl carboxylase were conducted. These are core enzymes involved in synthesis of milk fat. The PCR analyses were performed by Martin T. Sørensen and Peter Theil, Department of Animal Welfare, Health and Nutrition.

Feeding with large proportion of red clover significantly lowered the regulation of fatty acid synthase compared with the other feeding treatments. Lucerne silage tended to down regulated acetyl carboxylase. Dietary treatments did not affect regulation of desaturase.

Before sustainable conclusion can be made, the PCR data needs to be related with analysis of milk fatty acids composition and milk fat yield. These analyses are in preparation.

WP 4: Novel and gentle milk treatment for high quality organic milk with improved functionality

Using APV’s pilotscale unit for infusion pasteurization two trials have been performed, one with skimmed milk, and the other with whole milk. The milk was tested for enzyme activities (e.g alkaline phosphatase and xanthine oxidase), physical properties (e.g. viscosity and casein micelle size) and sensory properties.

The mains results are:

- Infusion pasteurization ensures proper microbial elimination.
- Alkaline phosphatase (AP) was properly inactivated in skim milk, but in whole milk appears to be reactivated with increasing temperature of pasteurization, something that does not take place when conventional pasteurization is used, but may also happen in UHT-treated milk. The reactivation of AP may have legal implications as the activity of this enzyme is used as a standard test for proper pasteurization.
- The activity of xanthine oxidase (XO) is reduced with increasing temperature. Thus, XO is not reactivated when using infusion pasteurization treatment.
- Whey protein denaturation is affected by both holding time and temperature, and seems to be more severe in whole milk with up to ~25% β-lactoglobulin and ~10% α-lactalbumin denatured at highest temperature compared with skim milk with ~18% and ~8% denatured, respectively.
- Infusion pasteurization appears to increase the size of casein micelles and the milk viscosity more than in milk subjected to conventional pasteurization. Thus the functional properties can be expected to differ between infusion-pasteurized and conventionally pasteurized milk.

Sensory experiments
A consumer test (n=69) of four organic full fat milks (2 infusion pasteurized milks (holding time 0.7; 90°C or 120°C), 1 low pasteurized milk (LP) and 1 reference sample purchased from the shop (Ref.; comparable to the LP milk in terms of dairy, cow race and age of the milk) showed that infusion pasteurized milk at high temperature (holding time 0.7 s, 120°C) was more liked and perceived more fresh than traditionally low pasteurized milk (LP and Ref.).

In summary, these results show that infusion-pasteurized milk exhibits microbial safety but significant differences when compared to conventionally pasteurized milk, thus confirming our original hypothesis that this treatment could be used to produce milk differentiating from the other milk on the market. The differences appear in the physical and chemical properties as well as in the sensory quality and thus the functional properties of the milk are undoubtedly also affected.

C.2 Fulfilment of deliverables and milestones

(To be completed for each work package)

[Tabeller over deliverables og milestones fra ansøgningen opstilles for hver workpackage. Deliverables er forskellige former for offentligt tilgængelige produkter (artikler, rapporter, informationsmøder etc.) og det skal angives, hvilken form for produkt der er tale om. Milestones er væsentlige trin i forskningsprocessen. Der skal angives et tidspunkt for både deliverables og milestones (milestones ligger typisk tidligere end deliverables). Ændringer i deliverables og milestones forsynes med en notits om, at de er ændret i forhold til ansøgningen, og hvorfor de er ændret. Alle deliverables og milestones skal stå i rapporten, og de, der er passeret, mærkes af som udførte, eller der angives en ny dato. Større afvigelser kommenteres i D.]

Deliverables list (from application)

Workpackage 1						
Deliverable No	**Deliverable title**	**Lead scientist**	**Delivery date**	**Allocated scientific person moths**	**Type of deliverable**	**Fulfilled (ok) or deviations (d)***
D1.1	Yield and composition of milk from cows fed high levels of different legumes in relation to the composition of the legumes	JHN	March 2007	9	S	D
D1.2	The effect of the sward composition on the milk quality – report from workshop	KAS	May 2008	2	R	
D1.3	The effect of winter feeding on the milk quality– report from workshop	TKR	May 2009	2	R	
D1.4	Popular papers on the effect of grassland species on milk quality –together with WP2	KAS	July 2009	1	P	
D1.5	Strategies for feed supply in relation to milk quality, productivity and economy at farm level	TKR	Dec 2009	6	S	

(The nature of the deliverables must be indicated by S = publication in scientific journal with peer review; P = publication in journals without peer review; R = reports; C = presentation at meetings and congresses or O = other types of deliverables, e.g., prototypes, models, websites, etc.).

Milestones list (from application)

Workpackage 1			
Milestone No	**Milestone title**	**Delivery date**	**Fulfilled (ok) or deviations (d)***
M1.1	Contract made with 8 farmers and start of registration	April 2006	OK
M1.2	First annual meeting at the farms	Oct. 2006	OK
M1.3	Grazing experiment at Rugballegaard finished	Sept. 2006	OK
M1.4	First round of experiment during winter period	Dec. 2007	
M1.5	Workshop with focus on pasture-milk quality	Feb.	

		2008	
M1.6	Workshop with focus on winterfeeding – milk quality	Feb. 2009	

** Deviations are to be further discussed in D*

Deliverables list (from application)

Workpackage 2						
Delive-rable No	**Deliverable title**	**Lead scien-tist**	**Delivery date**	**Allocated scientific person moths**	**Type of de-liver-able**	**Fulfilled (ok) or devia-tions (d)***
D2.1	Shelf life of milk as affected by feeding of the dairy cow	JHN	Oct. 2008	9	S	
D2.2	Sensory attributes of milk from cows at winter feed	WB	June09	11	S	
D2.3	Sensory attributes of milk from cows at summer grazing	WB	Dec 09	11	S	
D2.4	Composition and flavour of milk from cows at summer grazing	JHN	Dec 09	10	S	
D2.5	Evaluation of the relationship between objective chemical and sensory quality attributes of different organic milk types	JHN	Dec 09	8	S	
D2.6	Conjoint analysis of product information, consumer attitudes and purchase be-haviour of organic milk	WB	Dec 09	12	S	

** Deviations are to be further discussed in D*

Milestones list (from application)

Workpackage 2			
Mileston No	**Milestone title**	**Delivery date**	**Fulfilled (ok) or devia-tions (d)***
M2.1	Sensory studies of milk from intensive experiments with legumes has been performed	Sept. 2006	OK
M2.2	Analysis of milk from intensive experiments with legumes has been per-formed	Dec. 2006	OK
M2.3	Storage experiments of milk from different farms has been conducted	July 2008	
M2.4	Analysis of milk from farms using winter feed has been conducted	March 2009	
M2.5	Analysis of milk from farms using summer feed has been conducted	Oct. 2009	

** Deviations are to be further discussed in D*

Deliverables list (from application)

Workpackage 3						
Delive-rable No	**Deliverable title**	**Lead scien-tist**	**Delivery date**	**Allocated scientific person moths**	**Type of de-liver-able**	**Fulfilled (ok) or devia-tions (d)***
D3.1	Influence of feeding and cow breed on creaming in organic milk and effect of heat treatment	LW	Dec 07	6	S	

D3.2	Effect of grass feeding on enzymes involved in the synthesis of milk fat	LW	June 08	4	S	
D3.3	Evaluation of sustainable grass feeding combined with new milking systems in relation to lipolysis in milk	LW	July 08	5	S	
D3.4	Strategy for cooling and milking frequency for farmers using automatic milking	LW	Oct 08	4	R	

Milestones list (from application)

Workpackage 3			
Mileston No	**Milestone title**	**Delivery date**	**Fulfilled (ok) or deviations (d)***
M3.1	Methods to measure the expression of enzymes responsible for fat synthesis are developed	Oct 2006	OK
M3.2	Methods to analysis for agglutinins are developed	Oct. 2006	D
M3.3	Studies of how feeding influences creaming are conducted	Sept. 2007	
M3.4	Experiment with heat treatment are conducted	Sept. 2007	
M3.5	Case studies of AMS using pasture have ended	Dec. 2007	

** Deviations are to be further discussed in D*

Deliverables list (from application)

Workpackage 4						
Deliverable No	**Deliverable title**	**Lead scientist**	**Delivery date**	**Allocated scientific person moths**	**Type of deliverable**	**Fulfilled (ok) or deviations (d)***
D4.1	Effect of infusion pasteurization alone or in combination with micro-filtration on the shelf-life of milk	JHN	June 07	5	S	D
D4.2	Effect of infusion pasteurization alone or in combination with micro-filtrationon microflora	RI	June 08	8	S	
D4.3	Paper in a Danish trade journal summarizing how organic milk can best be trated for drinking milk or cheese making	RI	March 08	1	P	
D4.4	Effect of infusion pasteurization alone or in combination with micro-filtration on the composition of flavour components	JHN	Oct 08	9	S	
D4.5	Effect of infusion pasteurization alone or in combination with micro-filtration on whey protein denaturation and enzyme activity	JHN	Dec 08	9	S	
D4.6	Effect of infusion pasteurization alone or in combination with micro-filtration in relation to changes in the milk fat globule membrane	JHN	Dec 08	7	S	
D4.7	Effect of infusion pasteurization alone or in combination with micro-filtration on	RI	Dec 08	15	S	

	suitability of milk for production of high quality cheese					
D4.8	Effect of infusion pasteurization alone or in combination with micro-filtration on milk on sensory quality with special emphasis on “freshness”	WB	Dec 08	6	S	

Milestones list (from application)

Workpackage 4			
Mileston No	**Milestone title**	**Delivery date**	**Fulfilled (ok) or deviations (d)***
M4.1	Establishment of the limits for the applied treatments (infusion pasteurization and micro-filtration) ensuring microbial safety of the resulting milk	March 2007	D
M4.2	Mapping of the influence of the applied treatments (infusion pasteurization and micro-filtration) on the chemical attributes of the milk	June 2008	
M4.3	Mapping of the influence of the applied treatments (infusion pasteurization and micro-filtration) on denaturation of the major whey proteins and their aggregation and reaction with other proteins in milk	June 2008	
M4.4	Elucidation of how the applied treatments (infusion pasteurization and micro-filtration) affect the flavour of milk and set up of a definition of the descriptors ‘freshness’. Including correlation to chemical attributes	June 2009	
M4.5	Determination of the best treatment for fresh drinking milk and for further processing (cheese making)	June 2009	

D. Description of deviations and subsequent adjustments of plans

[Her skal der kun stå en kort forklaring på de afvigelser, der er anført i C.2, og en beskrivelse af de ændringer i planerne, det har givet anledning til. Der skal ikke gives resultater eller konklusioner]

D.1.1 Due to the huge amount of samples to be analyzed, results were not available before September 2007. The suggested publication is therefore in the process of being written and is expected to be submitted by the end of 2007. Some of the result have been published in popular papers and in abstracts to meetings.

D3.2 Publication is postponed until end of 2007 where the last results have been evaluated

M3.2 Postponed until end of 2007 where Lars Wiking will return from a post doc visit in Ghent

WP 4: No experiments have yet been performed using microfiltration, they are however planned for september 2007. This is caused by limited availability of APV's pilot plant.

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

http://orgprints.org/view/projects/DA3_ORMILKQUAL.html

Kristensen, Troels; Eriksen, Jørgen and Søegaard, Karen (2007) Afgræsning af græsblandinger med bælgplanter og cikorie. *Ny Kvægforskning* 5(2):2

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abstract:
Romano, R. Næs, T. Brockhoff. P.B (2007). The use of analysis of variance and three-way factor analysis methods for studying the quality of a sensory panel, CLADAG2007 Abstracts.

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

Oral presentation:
The use of analysis of variance and three-way factor analysis methods for studying the quality of a sensory panel authors: Rosaria Romano, Tormod Næs, Per Bruun Brockhoff
conference: Sixth Scientific Meeting of the CLAssification and Data Analysis Group of the Italian Statistical Society, University of Macerata (Italy), September 12th - 14th, 2007.

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

F. Scientific education

G. National and international cooperation

Critical reflection on the project

[Her gives der en kritisk refleksion over projektets planer, forløb og resultater. Det kan rumme refleksioner over det videnskabelige håndværk med hensyn til fx metodevalg, prøvbarhed og udførelse; over eventuelle ændringer i relevans som følge af ændringer i omverdenen eller som følge af den læring der er sket i projektet; samt over aspekter af forskningsudvikling, især i relation til FØJOs mål om at udvikle tværgående og relevant forskning (og hvad der evt. kunne gøres bedre). Her diskuteres endvidere væsentlige justeringer af projektet som følge af afvigelser fra planen (fra C.2 og D) og andre væsentlige ændringer.]

The project is on-going and we expect that the project will contribute with new knowledge about the relation between feeding of the dairy cow and milk composition/flavour and new knowledge about gentle pasteurisation techniques.

8. Budget

A. Account for any change in budgets

B. Budget for the whole project (1.000 DKK)

Total consumption of funds from DARCOF and expected consumption this year and coming years

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Man-months							
Scientific personnel	191	26	78	55	30		189
Technical personnel	81,9	20,3	29,6	22,6	10,90		83,4

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Salaries							
Scientific personnel	6957	988	2814	1958	1175		6935
Technical personnel	2283	531	830	646	332		2339
Other operational costs	2025	221	763	693	319		1995
Equipment	72	12	46	11			69
Others (please specify)	329	186	58	64	21		329
Direct costs	11666	1938	4511	3372	1847		11667
Indirect costs (20% of direct costs)	2334	387	903	674	369		2333
Total	14000	2324	5414	4046	2216		14000

Appendix I. Detailed budget

A. Budget for each participating institute (1.000 DKr)

Name of Institute and department: Faculty of Agricultural Sciences

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Man-months							
Scientific personnel	119	21	47	34	15		117
Technical personnel	71,9	17,8	25,4	20,6	10,9		74,4

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Salaries							
Scientific personnel		822	1748	1253	715		4538
Technical personnel		445	679	581	332		2037
Other operational costs	1660	139	650	611	260		1659
Equipment	57		46	11			57
Others (please specify)	329	186	58	64	21		329
Direct costs	8620	1592	3181	2520	1328		8620
Indirect costs (20% of direct costs)	1725	318	637	504	265		1725
Total	10345	1910	3818	3025	1593		10345

Comments:

Name of Institute and department: University of Copenhagen, Faculty of Life Sciences, Department of Food Science

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Man-months							
Scientific personnel	72	5	311	211	152		722
Technical personnel	10	2.5	4.55	20			99

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Salaries							
Scientific personnel	2366	166	1066	705	460	0	2397
Technical personnel	300	86	151	65	0	0	302
Other operational costs	365	82	113	82	59	0	336
Equipment	15	12	0	0	0	0	12
Others (please specify)	0	0	0	0	0	0	0
Direct costs	3046	345	1330	852	519	0	3046
Indirect costs (20% of direct costs)	609	69	266	170	104	0	609
Total	3655	414	1596	1022	623	0	3655

Comments:

B. Budget for each participating department (1.000 DKK)

Name of Institute and department: Faculty of Agricultural Sciences, Department of Food Science

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Man-months							
Scientific personnel	81	11	36	27	5		79
Technical personnel	39,5	11	16,5	12	3		42,5

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Salaries							
Scientific personnel		381	1229	920	217		2747
Technical personnel	979	253	413	308	72		1046
Other operational costs	781	112	391	242	36		781
Equipment							
Others (please specify)							
Direct costs	4574	746	2033	1470	325		4574
Indirect costs (20% of direct costs)	915	149	407	294	65		915
Total	5489	895	2440	1764	390		5489

Comments:

Der forventes at blive flyttet kr. 67.000,- fra VIP-løn til TAP-løn i år 2007.

Name of Institute and department: Faculty of Agricultural Sciences, Department of Agricultural and Environment

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Man-months							
Scientific personnel	33	9	7	7	10	0	33
Technical personnel	31,9	6,8	8,6	8,6	7,9	0	31,9

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Salaries							
Scientific personnel	1553	395	327	333	498	0	1553
Technical personnel	991	192	266	273	260	0	991
Other operational costs	868	27	249	369	224	0	868
Equipment	57	0	46	11	0	0	57
Others (please specify)	329	186	58	64	21	0	329
Direct costs	3798	800	946	1050	1003	0	3798
Indirect costs (20% of direct costs)	760	160	189	210	200	0	760
Total	4558	960	1135	1260	1203	0	4558

Comments:

100.000 kr. has been transferred from 2007 to 2008 compared to the original budget.

Name of Institute and department: Faculty of Agricultural Sciences , Department of animal welfare and nutrition

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Man-months							
Scientific personnel	5	1	4	0	0	0	5
Technical personnel	0,5	0	0	0	0	0	0

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Salaries							
Scientific personnel		46	192	0	0	0	238
Technical personnel	13	0	0	0	0	0	0
Other operational costs	11	0	10	0	0	0	10
Equipment							
Others (please specify)							
Direct costs	248	46	202	0	0	0	248
Indirect costs (20% of direct costs)	50	9	41	0	0	0	50
Total	298	55	243	0	0	0	298

Comments:

Name of Institute and department: University of Copenhagen, Faculty of Life Sciences, Department of Food Science

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Man-months							
Scientific personnel	72	5	311	211	152		722
Technical personnel	10	2.5	4.55	20			99

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Salaries							
Scientific personnel	2366	166	1066	705	460	0	2397
Technical personnel	300	86	151	65	0	0	302
Other operational costs	365	82	113	82	59	0	336
Equipment	15	12	0	0	0	0	12
Others (please specify)	0	0	0	0	0	0	0
Direct costs	3046	345	1330	852	519	0	3046
Indirect costs (20% of direct costs)	609	69	266	170	104	0	609
Total	3655	414	1596	1022	623	0	3655

Comments:

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

Name of Institute and department: Faculty of Agricultural Sciences, Department of Food Sciences

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Man-months							
Scientific personnel	4	0,5	1	1	1		3,5
Technical personnel	0	3					3

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Salaries							
Scientific personnel	234	25	57	60	63		205
Technical personnel		80					80
Other operational costs	258	90	86	31			207
Equipment							
Others (please specify)							
Direct costs	492	195	143	91	63		492
Indirect costs (20% of direct costs)	98	39	29	18	12		98
Total	590	234	172	109	75		590

Comments:

Name of Institute and department: Faculty of Agricultural Sciences, Department of Agricultural Systems and Environment

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Man-months							
Scientific personnel	0	0	0	0	0	0	0
Technical personnel	0	0	0	0	0	0	0

Year:	Original budget	Consump-tion 2005/2006	Expected consump-tion 2007	2008	2009	2010	Total
Salaries							
Scientific personnel	0	3	0	0	0	0	3
Technical personnel	0	21	0	0	0	0	21
Other operational costs	30	0	10	0	0	0	10
Equipment	0	0	0	0	0	0	0
Others (please specify)	59	782	0	10	7	0	799
Direct costs	89	806	10	10	7	0	833
Indirect costs (20% of direct costs)	1090	177	274	296	305	0	1052
Total	1179	983	284	306	312	0	1885

Comments: