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Direktoratet for FødevarerErhverv



Danish Research Centre for Organic Farming



Application

for research funding under the research programme:

Research in Organic Food and Farming

International Research Co-operation and Organic Integrity

(DARCOF III 2005-2010)

Funded by the Ministry of Food, Agriculture and Fisheries
under the Finance and Appropriation Act, Sections 24.33.02.10

1. **Project title and acronym** (acronym max. 10 letters):

The effect of cropping systems on production and the environment (CROPSYS)

2. **Project manager** (name, title, address, telephone, fax and e-mail. For projects in which several institutes participate, one project manager must be appointed to head the project):

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3. The project is within the following research project theme:

The project addresses topic 3.5.1 on "The effects of cropping systems on production and environment". The project covers all the factors covered in this topic, except for the effect of different geological conditions for denitrification and the effect on P losses. The project will address the effects of the cropping systems on N losses from the root zone, including denitrification from the root zone, since we consider the root zone to be the area which is primarily affected by different farming systems, and the root zone is affected by different soil types and to a much lesser extent by different geological conditions. We will not consider the processes of P losses. However, we will measure changes on soil P availability under the different systems and this will give an indication of the potential for P losses.

4. Participating institute(s) (name, address, telephone, fax and e-mail):

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7. **Project duration:** 4.5 years From: January 2006 To: June 2010

8. **Main objective(s)**

The overall goal is to quantify productivity and environmental impacts of different organic and conventional cropping systems across a range of soil and climatic conditions, and to identify management measures which contribute significantly to a sustainable development of the individual cropping systems. The basic hypothesis is that organic cropping systems can be maintained with high productivity at low environmental impact through better crop rotation design and management, as modified by soil type and climate. This will be achieved through a better description of the role of soil N dynamics, soil properties and crop and weed dynamics in the different systems, and using modelling and scenario analyses to integrate and evaluate production-related and environmental indicators of sustainability.

9. **Project summary in Danish**

Moderne landbrugssystemer har en kraftig indflydelse på det omgivende miljø, og i Danmark er der særlig fokus på nitratudvaskning og drivhusgasemissioner fra landbruget. Bæredygtige landbrugssystemer skal også opfylde behovet for tilstrækkelige mængder og kvalitet i fødevarerne. I økologisk jordbrug er afgrødeproduktionen i betydelig grad afhængig af jordens frugtbarhed for at sikre næringsstofforsyningen. Jordfrugtbarheden vedligeholdes især via sammensætningen af sædskiftet (grøngødning og efterafgrøder) og via anvendelse af husdyrgødning. En forbedret anvendelse af disse for at forbedre afgrødeudbytter og reducere emissionerne til miljøet kræver en dybere forståelse af næringsstofomsætningen i jorden og af effekterne på afgrøde og ukrudt.

I 1997 blev der igangsat et langvarigt økologisk sædskifteforsøg på tre lokaliteter i Danmark. I 2005 bliver forsøget modificeret til også at inkludere et konventionelt sædskifte. De tre lokaliteter repræsenterer typiske jorde (sand, lerblandet sand og sandblandet ler) og klimaforhold for dansk landbrug. Designet af det nuværende 8-år gamle sædskifteforsøg tillader forsøgsmæssig adskillelse af effekter af helårsgrøngødning, efterafgrøder og gødning. Dette giver mulighed for at gennemføre en differentieret analyse af forskellige dyrkningsstrategier. Projektet vil udnytte dette enestående langvarige forsøg til en integreret undersøgelse af produktivitet og kvælstofstrømme i økologiske dyrkningssystemer.

Projektet vil kvantificere produktivitet og miljøpåvirkning af forskellige økologiske og konventionelle dyrkningssystemer på tværs af en række forskellige jordbundsmæssige og klimatiske forhold. Projektet vil også identificere dyrkningsforanstaltninger, som kan bidrage væsentligt til en bæredygtig udvikling de individuelle dyrkningssystemer. Dette vil blive opnået gennem en integreret forsøgs- og modelmæssig program, hvor målinger af nøgleindikatorer af produktivitet og miljøpåvirkning samt af de underliggende processer og af dynamiske jordparametre foregår i sædskifteforsøget. En simuleringsmodel (FASSET) og en livscyklusanalyse (LCA) model vil blive anvendt til at analysere forskellige dyrkningsscenerier. Resultatet vil være anvisninger til forbedring af den bæredygtige udvikling i økologiske planteproduktionssystemer i Danmark.

WP1 vil koordinere projektet og sikre en effektiv kommunikation mellem projektdeltagerne samt med interessenter. En fælles protokol for dyrkningsanvisninger og målinger i sædskifteforsøget vil blive vedligeholdt. Alle data fra sædskifteforsøget vil blive lagret i en database, hvortil alle projektdeltagere har adgang.

WP2 vil varetage dyrkningen i sædskifteforsøget. Forsøget indeholder tre 4-årige sædskifter, som repræsenterer et økologisk grøngødnings/salgsafgrøde sædskifte, et økologisk salgsafgrøde sædskifte og et

konventionelt salgsafgrøde sædskifte. Forsøget er udlagt i et faktorielt design, som også indeholder to gødningsbehandlinger og to efterafgrødebehandlinger. Med to gentagelser for hver systemkombination giver dette 64 parceller på hvert forsøgssted. Afgrødeudbytte og biomasse af afgrøde og ukrudt vil blive målt. Afgrødernes kvælstofoptagelse vil blive målt, og N₂-fikseringen i bælgplanter vil også blive målt.

WP3 vil måle nitratudvaskningen i alle dyrkningssystemer i sædskifteforsøget. Dette muliggør en tolkning af kort- og langtidseffekter af dyrkningssystemer og lokalitet på nitratudvaskningen. Udvasnkningen af opløst organisk kvælstof (DON) vil blive målt i en kampagne, som koordineres med målinger af DON i pløjelaget i WP5. Potentialet for optagelse af N i rødder i jordlag under de installerede sugeceller vil blive analyseret fra målinger af rodudvikling ved anvendelse af minirhizotroner og modellering (WP6).

WP4 vil måle lattergasemissionerne fra fire udvalgte behandlinger i sædskifteforsøget over en 12-måneders periode på to af forsøgsstederne. Prøver af pløjelaget vil blive taget fra den sandblandede lerjord for at undersøge effekter af dyrkningssystemet på denitrifikation og på forholdet mellem N₂ og N₂O. Desuden vil jordprøver blive udtaget i to dybder og undersøgt for total kvælstof og kulstof for undersøgelse af udviklingen i jordens kulstof og kvælstof.

WP5 vil kvantificere effekter af forskellige dyrkningssystemer på en række parametre for jordkvalitet (herunder porestørrelsesfordeling, luft permeabilitet, bearbejdbarhed, mineralsk N, DON, mikrobiel biomasse N). Målingerne vil blive gennemført over to år i sædskifteforsøget. Nogle målinger vil blive taget i alle dyrkningssystemer. Dog vil hovedparten af indsatsen blive koncentreret om de fire udvalgte dyrkningssystemer og de to forsøgssteder, som også anvendes i WP4. Desuden vil jordprøver blive analyseret for netto N-mineralisering og for mikrobielle biomasse puljer.

WP6 vil anvende statistiske metoder, simuleringmodeller (FASSET) og livscyklusvurdering (LCA) til at generalisere resultaterne fra sædskifteforsøget (WP2 til WP5) til andre jordbundsmæssige og klimatiske forhold og for alternative dyrkningsstrategier. Dette vil indeholde en vurdering af miljøpåvirkningen fra hele produktkæden for både økologiske og konventionelle dyrkningssystemer. Resultaterne vil blive anvendt til at kvantificere dyrkningsforanstaltninger, der kan bidrage væsentligt til en bæredygtig udvikling af økologiske dyrkningssystemer.

10. Budget:

The proposed budget must be inclusive of increases in the level of salaries and prices and specified on an annual basis. The proposed budget must specify the number of man-months and related salary costs for scientific staff and non-scientific staff, other direct costs and costs to buy equipment. To this should be added an overhead contribution of 20% of the direct costs.

Salary levels must not exceed union levels for comparable positions in the Public Service (e.g. laboratory assistant, researcher or senior researcher).

Official journeys must follow government regulations.

The applicants are generally expected to procure and make available all necessary equipment for the project themselves. Only in exceptional cases when this is not possible may expenditures for the acquisition of equipment be included in the budget for consideration.

Funding is provided exclusive of the recipient's input VAT (purchase VAT) and output VAT (sales VAT).

For government institutes funding is provided in accordance with the budget guidelines issued by the Ministry of Finance for research activities receiving programme funding and the funding is only granted for one year at a time.

If private business partners co-finance or take part in the project otherwise then all partners have to enter a co-operation agreement or provide other kind of documentation of the co-operation cf. 'Invitation til projektansøgninger'.

Note that budgets must be made for the entire project as well as for each participating institution.

Budget for the entire project—broken down by calendar year							
Budget item		From Ministry of Food, Agriculture and Fisheries		From place of work		From other sources	
		Person months	DKK	Person months	DKK	Person months	DKK
1st calendar year 2006	Salaries/academic staff	8	389000	0	11000		
	Salaries/techn.-adm. staff	14	411160	5	152400		
	Equipment		9300		0		
	Operational expenses		417610		0		
	Others (please specify below)		756300		707400		
	Total direct costs		1983370		870800		
Overhead (20 % of direct costs)		396800		174200			
Total		2380170		1045000			
2nd calendar year 2007	Salaries/academic staff	22	957724	4	141000		
	Salaries/techn.-adm. staff	33	1008901	5	147300		
	Equipment		105700		0		
	Operational expenses		587180		8000		
	Others (please specify below)		786700		735800		
	Total direct costs		3446205		1032100		
Overhead (20 % of direct costs)		689375		206500			
Total		4135580		1238600			
3rd calendar year 2008	Salaries/academic staff	23	1018507	4	146200		
	Salaries/techn.-adm. staff	31	978501	4	137600		
	Equipment		0		0		
	Operational expenses		569450		8400		
	Others (please specify below)		791700		754000		
	Total direct costs		3358158		1046200		
Overhead (20 % of direct costs)		671722		209300			
Total		4029880		1255500			
4th calendar year 2009	Salaries/academic staff	37	1976729	4	151800		
	Salaries/techn.-adm. staff	5	173800	0	11200		
	Equipment		0		0		
	Operational expenses		173900		8800		
	Others (please specify below)		55000		23500		
	Total direct costs		2379429		195300		
Overhead (20 % of direct costs)		475966		104500			
Total		2855395		299800			
5th calendar year 2010	Salaries/academic staff	8	427204	0	11000		
	Salaries/techn.-adm. staff	1	15000	0	0		
	Equipment		0		0		
	Operational expenses		51100		0		
	Others (please specify below)		0		0		
	Total direct costs		493304		11000		
Overhead (20 % of direct costs)		98781		19200			
Total		592085		30200			
Total for the 5 years		13993109		3869100			

Budget for each participating institution: Danish Institute of Agricultural Sciences, Dept. Agroecology [P1]						
Budget item	From Ministry of Food, Agriculture and Fisheries		From place of work		From other sources	
	Person months	DKK	Person months	DKK	Person months	DKK
1st calendar year 2006	Salaries/academic staff	6.5	318500			
	Salaries/techn.-adm. staff	5.8	167960			
	Equipment		9300			
	Operational expenses		281610			
	Others (please specify below)		756300		707400	
Total direct costs		1533670		707400		
Overhead (20 % of direct costs)		306800		141500		
Total		1840470		848900		
2nd calendar year 2007	Salaries/academic staff	14.5	656950	4.0	130000	
	Salaries/techn.-adm. staff	18.9	576100	0.4	10000	
	Equipment		105700			
	Operational expenses		398180		8000	
	Others (please specify below)		786700		735800	
Total direct costs		2523630		883800		
Overhead (20 % of direct costs)		504800		176800		
Total		3028430		1060600		
3rd calendar year 2008	Salaries/academic staff	15.5	708900	4.0	135200	
	Salaries/techn.-adm. staff	16.3	517300	0.4	10400	
	Equipment					
	Operational expenses		377550		8400	
	Others (please specify below)		791700		754000	
Total direct costs		2395450		908000		
Overhead (20 % of direct costs)		479100		181600		
Total		2874550		1089600		
4th calendar year 2009	Salaries/academic staff	28.5	1532900	4.0	140800	
	Salaries/techn.-adm. staff	4.5	146000	0.4	11200	
	Equipment					
	Operational expenses		139400		8800	
	Others (please specify below)		55000		23500	
Total direct costs		1873300		184300		
Overhead (20 % of direct costs)		374700		36900		
Total		2248000		221200		
5th calendar year 2010	Salaries/academic staff	5.0	291000			
	Salaries/techn.-adm. staff	0.5	15000			
	Equipment					
	Operational expenses		40300			
	Others (please specify below)					
Total direct costs		346300				
Overhead (20 % of direct costs)		69300				
Total		415600				
Total for the 5 years		10407050		3220300		

Other costs include expenses for carrying out management and measurements in WP2/3 in the CRO-experiment.

Budget for each participating institution: Danish Institute of Agricultural Sciences, Dept. Int. Pest Management [P2]						
Budget item	From Ministry of Food, Agriculture and Fisheries		From place of work		From other sources	
	Person months	DKK	Person months	DKK	Person months	DKK
1st calendar year 2006	Salaries/academic staff	1.5	70500			
	Salaries/techn.-adm. staff	8.3	243200	5.2	152400	
	Equipment					
	Operational expenses		136000			
	Others (please specify below)					
Total direct costs		449700		152400		
Overhead (20 % of direct costs)		90000		30500		
Total		539700		182900		
2nd calendar year 2007	Salaries/academic staff	1.5	73400			
	Salaries/techn.-adm. staff	8.5	259300	4.5	137300	
	Equipment					
	Operational expenses		138000			
	Others (please specify below)					
Total direct costs		470600		137300		
Overhead (20 % of direct costs)		94200		27500		
Total		564900		164800		
3rd calendar year 2008	Salaries/academic staff	1.5	76400			
	Salaries/techn.-adm. staff	9	286200	4	127200	
	Equipment					
	Operational expenses		135000			
	Others (please specify below)					
Total direct costs		497600		127200		
Overhead (20 % of direct costs)		99600		25500		
Total		597200		152700		
4th calendar year 2009	Salaries/academic staff	3	159000			
	Salaries/techn.-adm. staff	0.8	27800			
	Equipment					
	Operational expenses		25000			
	Others (please specify below)					
Total direct costs		211800				
Overhead (20 % of direct costs)		42400				
Total		254200				
5th calendar year 2010	Salaries/academic staff	0.5	27300			
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses		9800			
	Others (please specify below)					
Total direct costs		37100				
Overhead (20 % of direct costs)		7500				
Total		44600				
Total for the 5 years		2000600		500400		

Budget for each participating institution: Danish Institute of Agricultural Sciences, Dept. Genetics Biotechnology [P3]						
Budget item	From Ministry of Food, Agriculture and Fisheries		From place of work		From other sources	
	Person months	DKK	Person months	DKK	Person months	DKK
1st calendar year 2006	Salaries/academic staff					
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses					
	Others (please specify below)					
Total direct costs						
Overhead (20 % of direct costs)						
Total						
2nd calendar year 2007	Salaries/academic staff					
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses					
	Others (please specify below)					
Total direct costs						
Overhead (20 % of direct costs)						
Total						
3rd calendar year 2008	Salaries/academic staff					
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses					
	Others (please specify below)					
Total direct costs						
Overhead (20 % of direct costs)						
Total						
4th calendar year 2009	Salaries/academic staff	4	217200			
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses		2000			
	Others (please specify below)					
Total direct costs		219200				
Overhead (20 % of direct costs)		43840		65400		
Total		263040		65400		
5th calendar year 2010	Salaries/academic staff	1	56500			
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses		1000			
	Others (please specify below)					
Total direct costs		57500				
Overhead (20 % of direct costs)		11500		17000		
Total		69000		17000		
Total for the 5 years		332040		82400		

Budget for each participating institution: Risø National Laboratory, Biosystems Department [P4]						
Budget item	From Ministry of Food, Agriculture and Fisheries		From place of work		From other sources	
	Person months	DKK	Person months	DKK	Person months	DKK
1st calendar year 2006	Salaries/academic staff					
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses					
	Others (please specify below)					
Total direct costs		0				
Overhead (20 % of direct costs)		0				
Total		0				
2nd calendar year 2007	Salaries/academic staff	5	187374			
	Salaries/techn.-adm. staff	2	53501			
	Equipment					
	Operational expenses		13000			
	Others (please specify below)					
Total direct costs		253875				
Overhead (20 % of direct costs)		50775				
Total		304650				
3rd calendar year 2008	Salaries/academic staff	5	193207			
	Salaries/techn.-adm. staff	2	55001			
	Equipment					
	Operational expenses		17500			
	Others (please specify below)					
Total direct costs		265708				
Overhead (20 % of direct costs)		53142				
Total		318850				
4th calendar year 2009	Salaries/academic staff	1	27629			
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses		7500			
	Others (please specify below)					
Total direct costs		35129				
Overhead (20 % of direct costs)		7026				
Total		42155				
5th calendar year 2010	Salaries/academic staff	1	28404			
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses					
	Others (please specify below)					
Total direct costs		28404				
Overhead (20 % of direct costs)		5681				
Total		34085				
Total for the 5 years		699739				

Budget for each participating institution: Copenhagen University, Biological Institute						
Budget item	From Ministry of Food, Agriculture and Fisheries		From place of work		From other sources	
	Person months	DKK	Person months	DKK	Person months	DKK
1st calendar year 2006	Salaries/academic staff		0.2	11000		
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses					
	Others (please specify below)					
Total direct costs						
Overhead (20 % of direct costs)						
Total						
2nd calendar year 2007	Salaries/academic staff	1	40000	0.2	11000	
	Salaries/techn.-adm. staff	4	120000			
	Equipment					
	Operational expenses		38000			
	Others (please specify below)					
Total direct costs		198000				
Overhead (20 % of direct costs)		39600				
Total		237600				
3rd calendar year 2008	Salaries/academic staff	1	40000	0.2	11000	
	Salaries/techn.-adm. staff	4	120000			
	Equipment					
	Operational expenses		39400			
	Others (please specify below)					
Total direct costs		199400				
Overhead (20 % of direct costs)		39880				
Total		239280				
4th calendar year 2009	Salaries/academic staff	1	40000	0.2	11000	
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses					
	Others (please specify below)					
Total direct costs		40000				
Overhead (20 % of direct costs)		8000				
Total		48000				
5th calendar year 2010	Salaries/academic staff	0.6	24000	0.2	11000	
	Salaries/techn.-adm. staff					
	Equipment					
	Operational expenses					
	Others (please specify below)					
Total direct costs		24000				
Overhead (20 % of direct costs)		4800				
Total		28800				
Total for the 5 years		553680		55000		

11. Signatures:

Name	Institute	Date	Signature
Project manager:	Danish Institute of Agricultural Sciences (Dept. Agroecology)		
Institute management:	Danish Institute of Agricultural Sciences (Dept. Agroecology)		
Institute management:	Danish Institute of Agricultural Sciences (Dept. Integrated Pest Man.)		
Institute management:	Danish Institute of Agricultural Sciences (Dept. Genetics & Biotech.)		
Institute management:	Risø National Laboratory (Biosystems Department)		
Institute management:	Copenhagen University (Biological Institute)		

12. Description of the project:

The description of the project must be given in Annex 1 and according to the guidelines described herein.