



MINISTERIET FOR
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Ministeriet for Fødevarer, Landbrug og Fiskeri
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

Application deadline 15th March 2005 at 12:00 a.m.

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

Organic cropping Systems for Vegetable production, - product Quality, natural Regulation and Environmental effects (VEG-QUIRE)

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** (name of the project theme according to 'Invitation til projektansøgninger'. Include argumentation, max. 10 lines, if the project is only a part of a project theme):

3.2.4 Kvalitet af grønsager og frugt i økologiske dyrkningssystemer

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

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5. Contact persons (title, name, address, telephone, fax and e-mail of one contact person appointed to represent each participating institute):

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6. Project staff (title, name, address, telephone, fax and e-mail):

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Technician Christina Wolsted, Department of Ecology, KVL, Thorvaldsensvej 40, DK-1871 Frederiksberg C, Phone +45 3528 2688, Fax +45 3528 2670, E-mail cw@kvl.dk

7. **Project duration:** 5 years From: Nov. 2005 To: Oct. 2010
(please give month and year in 'From' / 'To')

8. **Main objective(s)** (maximum 10 lines):

Our objective is to compare cropping systems for vegetable production, and study their effects on product quality, natural regulation in the field and environmental effects. We will compare one conventional and three organic systems. The organic strategies will vary in strategies for management of plant nutrients and pests, strategies which can affect vegetable quality and environmental effects. Product quality is very complex, and our goal is to study it using a number of different approaches. We will measure taste effects, storability, post harvest diseases, metabolic activity and contents of selected secondary metabolites which are known to be related to human health. The new method of proteomic analysis will be employed to get a broader understanding of the effects on the crops. We will study natural insect enemies, especially the regulation caused by insect pathogenic fungi. We will study the effect of the different systems on nutrient use efficiency and nitrogen leaching losses. Finally, the yields and costs of the systems will be compared to the documented quality and environmental effects.

9. Project summary in Danish (approximately 1 page, suitable for publication):

Formålet med dette projekt er at bidrage til forståelsen af de effekter økologiske dyrkningsmetoder har på miljøet og på kvaliteten af grønsager. Økologisk jordbrug har som mål at producere produkter af en bedre kvalitet og at producere dem på en miljøvenlig måde. Afsætning og offentlig støtte til økologisk jordbrug bygger på en forventning om at man når disse mål. Hvis man vil udbygge interessen for økologisk jordbrug, er der behov for at dokumentere, at man faktisk når de mål man har opstillet.

Det er ikke let at dokumentere dette, hvilket mange års forskning har vist. Når det er så svært at dokumentere dette, så skyldes det ikke mindst to forhold: 1) effekterne på kvalitet og miljø er særdeles komplekse og derfor svære at studere, og 2) økologisk produktion udgør ikke ét veldefineret dyrkningssystem; inden for reglerne for økologisk jordbrug kan der dyrkes på mange meget forskellige måder. Økologisk jordbrug udvikler sig løbende, og det kan få nogle til at stille spørgsmålstegn ved, om man derved bevæger sig væk fra det oprindelige grundlag.

For at bidrage til besvarelsen af disse spørgsmål, vil vi sammenligne 4 forskellige dyrkningssystemer, 1 konventionelt og 3 økologiske. Alle de økologiske systemer vil overholde reglerne for økologisk dyrkning, men på meget forskellig vis. Et system vil være næsten som det konventionelle, men selvfølgelig med organisk gødning og uden sprøjtemidler. I det næste vil grøngødning blive dyrket i efteråret så tit som muligt. I det sidste vil striber af efterafgrøderne blive efterladt som mellemafgrøder imellem grønsagsrækkerne især for at forbedre vilkårene for de naturlige reguleringsmekanismer. Tilsammen vil disse systemer dække en stor variation i dyrkningsforholdene. Der er systemer med og uden kemiske hjælpestoffer, men også store variationer i de biologiske forhold afgrøderne møder i form af skadedyr og svampe, nytteorganismer og planter. Der vil blive store forskelle i næringsstofbalancer og i tilgængeligheden af næringsstoffer for afgrøderne, med de effekter det kan have på produktkvalitet og miljø.

Kvaliteten af grønsagsprodukterne vil blive undersøgt på et antal forskellige måder, for på den måde at dække den store kompleksitet. Vi vil måle koncentration af sekundære stoffer i kål, salat og gulerod, med fokus på stoffer som har betydning for menneskelig sundhed. Vi vil måle de kvalitetsfaktorer der er afgørende for salg af produkterne, men også måle smag og indhold af flygtige aromastoffer. Aspekter af produkternes holdbarhed vil blive målt. Gulerødder fra de forskellige dyrkningssystemer vil blive lagt på lager, og samspillet imellem gulerøddernes fysiologi, metaboliske aktivitet, indholdsstoffer og udviklingen af svampesygdomme vil blive undersøgt. Her vil også blive gennemført et detailstudium på en enkelt betydende lagersygdom, hvor samspillet kan undersøges gennem de enkelte faser i sygdomsudviklingen.

For at få et endnu bredere udtryk for dyrkningssystemernes effekter på afgrøderne vil vi undersøge grønsagerne med de nyudviklede metoder til proteomanalyse. Disse undersøgelser viser bredt hvilke proteiner der udtrykkes i planterne, altså også de proteiner der som enzymer er aktive i produktionen af sekundære stoffer og for planternes energimetabolisme. Når det er identificeret hvilke proteiner der især påvirkes, kan deres funktion efterfølgende klarlægges. Resultaterne fra proteomanalysen skal underbygge de resultater der opnås ved de andre studier af kvalitet, og give et grundlæggende indblik i hvordan planterne påvirkes af dyrkningsmetoderne.

Naturlige reguleringsmekanismer i marken vil blive undersøgt ved studier af insektpatogene svampe i jorden og på skadedyr, og af forekomst og diversitet af nytteinsekter. Det vil specifikt blive undersøgt hvordan insektpatogene svampe regulerer skadelige insekter. Ved at undersøge dette i de 4 systemer kan vi se hvordan brug af sprøjtemidler og pesticider, dyrkning af efterafgrøder og dyrkning af mellemafgrøder påvirker disse forhold.

Endelig vil vi studere de forskellige systemers næringsstofbalancer, rodvækst og effekt på udvaskning af kvælstof. Det konventionelle og to af de økologiske systemer er allerede veludviklede systemer, mens især systemet med mellemafgrøder er endnu ikke er det. Det rummer mange spændende muligheder, men også problemer. Vi vil derfor arbejde videre med at udvikle dette dyrkningssystem. Endelig vil vi analysere udbytte og omkostninger ved de forskellige systemer. Dette vil blive sammenholdt med de effekter der opnås på kvalitet, biodiversitet og miljø, for at illustrere hvilke omkostninger der er ved at nå de målte effekter.

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 each participating institution — Name of institution: Total budget for all institutions						
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 2005	Salaries/academic staff	0,5	23.350	0,0	0	
	Salaries/techn.-adm. staff	0,0	0	2,0	56.200	
	Equipment		0		0	
	Operational expenses		5.000		0	
	Others (please specify below)		0		0	
Total direct costs		30.350		56.200		
Overhead (20 % of direct costs)		6.070		11.240		
Total		36.420		67.440		
2nd calendar year 2006	Salaries/academic staff	37,0	1.638.855	3,5	146.667	
	Salaries/techn.-adm. staff	24,5	686.658	4,0	109.300	
	Equipment		15.000		40.000	
	Operational expenses		344.149		10.000	
	Others (please specify below)		5.305		0	
Total direct costs		2.689.967		305.967		
Overhead (20 % of direct costs)		537.993		61.193		
Total		3.227.960		367.160		
3rd calendar year 2007	Salaries/academic staff	38,0	1.640.466	4,5	205.417	
	Salaries/techn.-adm. staff	26,5	742.044	4,0	113.400	
	Equipment		0		40.000	
	Operational expenses		403.466		10.000	
	Others (please specify below)		10.930		0	
Total direct costs		2.796.906		368.817		
Overhead (20 % of direct costs)		559.381		73.763		
Total		3.356.287		442.580		
4th calendar year 2008	Salaries/academic staff	32,0	1.439.938	4,5	212.131	
	Salaries/techn.-adm. staff	27,0	786.897	4,0	117.600	
	Equipment		0		40.000	
	Operational expenses		384.531		10.000	
	Others (please specify below)		11.260		0	
Total direct costs		2.622.626		379.731		
Overhead (20 % of direct costs)		524.525		75.946		
Total		3.147.151		455.677		
5th calendar year 2009	Salaries/academic staff	25,0	1.222.116	4,5	218.912	
	Salaries/techn.-adm. staff	17,4	496.180	4,0	121.900	
	Equipment		0		40.000	
	Operational expenses		257.162		10.000	
	Others (please specify below)		5.630		0	
Total direct costs		1.981.088		390.812		
Overhead (20 % of direct costs)		396.218		78.162		
Total		2.377.306		468.974		
6th calendar year 2010	Salaries/academic staff	19,5	1.027.081	4,5	225.861	
	Salaries/techn.-adm. staff	1,1	38.622	3,5	109.200	
	Equipment		0		40.000	
	Operational expenses		57.410		10.000	
	Others (please specify below)		5.950		0	
Total direct costs		1.129.063		385.061		
Overhead (20 % of direct costs)		225.813		77.012		
Total		1.354.876		462.073		
Total for the 5 years		13.500.000		2.263.906		

Budget for each participating institution — Name of institution: DIAS, Hort							
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 2005	Salaries/academic staff	0,5	25.350				
	Salaries/techn.-adm. staff	0,0	0	2,0	56.200		
	Equipment						
	Operational expenses						
	Others (please specify below)		5.000				
Total direct costs			30.350		56.200		
Overhead (20 % of direct costs)			6.070		11.240		
Total			36.420		67.440		
2nd calendar year 2006	Salaries/academic staff	9,0	468.900		0		
	Salaries/techn.-adm. staff	10,0	293.000	1,0	29.300		
	Equipment						
	Operational expenses						
	Others (please specify below)		70.000				
Total direct costs			831.900		29.300		
Overhead (20 % of direct costs)			166.380		5.860		
Total			998.280		35.160		
3rd calendar year 2007	Salaries/academic staff	8,0	428.800	1,0	53.600		
	Salaries/techn.-adm. staff	9,5	288.800	1,0	30.400		
	Equipment						
	Operational expenses						
	Others (please specify below)		75.033				
Total direct costs			792.633		84.000		
Overhead (20 % of direct costs)			158.527		16.800		
Total			951.160		100.800		
4th calendar year 2008	Salaries/academic staff	8,5	468.350	1,0	55.100		
	Salaries/techn.-adm. staff	10,0	316.000	1,0	31.600		
	Equipment						
	Operational expenses						
	Others (please specify below)		70.000				
Total direct costs			854.350		86.700		
Overhead (20 % of direct costs)			170.870		17.340		
Total			1.025.220		104.040		
5th calendar year 2009	Salaries/academic staff	9,0	509.400	1,0	56.600		
	Salaries/techn.-adm. staff	7,0	230.300	1,0	32.900		
	Equipment						
	Operational expenses						
	Others (please specify below)		70.000				
Total direct costs			809.700		89.500		
Overhead (20 % of direct costs)			161.940		17.900		
Total			971.640		107.400		
6th calendar year 2010	Salaries/academic staff	11,0	640.200	1,0	58.200		
	Salaries/techn.-adm. staff	1,0	34.200	1,0	34.200		
	Equipment						
	Operational expenses						
	Others (please specify below)		15.000				
Total direct costs			689.400		92.400		
Overhead (20 % of direct costs)			137.880		18.480		
Total			827.280		110.880		
Total for the 5 years			4.810.000		525.720		

Budget for each participating institution — Name of institution: DIAS, Food							
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 2005	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 2006	Salaries/academic staff	6,0	297.455				
	Salaries/techn.-adm. staff	6,5	193.158				
	Equipment						
	Operational expenses		85.941				
	Others (please specify below)		5.305				
Total direct costs			581.859				
Overhead (20 % of direct costs)			116.372				
Total			698.231				
3rd calendar year 2007	Salaries/academic staff	5,0	252.941				
	Salaries/techn.-adm. staff	6,0	200.269				
	Equipment						
	Operational expenses		135.751				
	Others (please specify below)		10.930				
Total direct costs			599.891				
Overhead (20 % of direct costs)			119.978				
Total			719.869				
4th calendar year 2008	Salaries/academic staff	5,0	265.588				
	Salaries/techn.-adm. staff	6,0	210.283				
	Equipment						
	Operational expenses		139.849				
	Others (please specify below)		11.260				
Total direct costs			626.980				
Overhead (20 % of direct costs)			125.396				
Total			752.376				
5th calendar year 2009	Salaries/academic staff	6,0	332.216				
	Salaries/techn.-adm. staff	2,4	82.848				
	Equipment						
	Operational expenses		36.482				
	Others (please specify below)		5.630				
Total direct costs			457.176				
Overhead (20 % of direct costs)			91.435				
Total			548.611				
6th calendar year 2010	Salaries/academic staff	1,5	90.389				
	Salaries/techn.-adm. staff	0,1	4.422				
	Equipment						
	Operational expenses		5.950				
	Others (please specify below)						
Total direct costs			100.761				
Overhead (20 % of direct costs)			20.152				
Total			120.913				
Total for the 5 years			2.840.000				





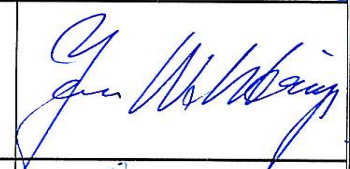
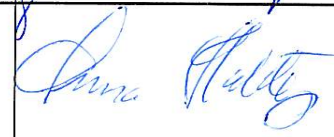
Budget for each participating institution — Name of institution: SDU, CPA							
Budget item		From Ministry of Food, Agriculture and Fisheries		From place of work		From other sources	
		Person months	DKK	Person months	DKK	Person months	DKK
1st calendar year 2005	Salaries/academic staff						
	Salaries/techn.-adm. staff						
	Equipment						
	Operational expenses						
	Others (please specify below)						
Total direct costs							
Overhead (20 % of direct costs)							
Total							
2nd calendar year 2006	Salaries/academic staff	3,0	107.500	2	71.667		
	Salaries/techn.-adm. staff	6,0	137.500	0	0		
	Equipment		0		40.000		
	Operational expenses		88.208		0		
	Others (please specify below)		0		0		
Total direct costs			333.208		111.667		
Overhead (20 % of direct costs)			66.642		22.333		
Total			399.850		134.000		
3rd calendar year 2007	Salaries/academic staff	3,0	110.725	2	73.817		
	Salaries/techn.-adm. staff	9,0	187.975	0	0		
	Equipment		0		40.000		
	Operational expenses		80.682		0		
	Others (please specify below)		0		0		
Total direct costs			379.382		113.817		
Overhead (20 % of direct costs)			75.876		22.763		
Total			455.258		136.580		
4th calendar year 2008	Salaries/academic staff	0,0	0	2	76.031		
	Salaries/techn.-adm. staff	9,0	193.614	0	0		
	Equipment		0		40.000		
	Operational expenses		80.682		0		
	Others (please specify below)		0		0		
Total direct costs			274.296		116.031		
Overhead (20 % of direct costs)			54.859		23.206		
Total			329.155		139.237		
5th calendar year 2009	Salaries/academic staff	0,0	0	2,0	78.312		
	Salaries/techn.-adm. staff	8,0	183.032	0,0	0		
	Equipment		0		40.000		
	Operational expenses		80.680		0		
	Others (please specify below)		0		0		
Total direct costs			263.712		118.312		
Overhead (20 % of direct costs)			52.742		23.662		
Total			316.454		141.974		
6th calendar year 2010	Salaries/academic staff	3,0	120.992	2,0	80.661		
	Salaries/techn.-adm. staff			0,0	0		
	Equipment		0		40.000		
	Operational expenses		3.410		0		
	Others (please specify below)		0		0		
Total direct costs			124.402		120.661		
Overhead (20 % of direct costs)			24.880		24.132		
Total			149.282		144.793		
Total for the 5 years			1.650.000		696.586		

Budget for each participating institution — Name of institution: KVL, PIBio							
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 2005	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 2006	Salaries/academic staff	9,0	395.000	0,5	25.000		
	Salaries/techn.-adm. staff	2,0	63.000	1,0	30.000		
	Equipment		15.000				
	Operational expenses		50.000				
	Others (please specify below)						
Total direct costs			523.000		55.000		
Overhead (20 % of direct costs)			104.600		11.000		
Total			627.600		66.000		
3rd calendar year 2007	Salaries/academic staff	10,0	392.000	0,5	26.000		
	Salaries/techn.-adm. staff	2,0	65.000	1,0	31.000		
	Equipment						
	Operational expenses		42.000				
	Others (please specify below)						
Total direct costs			499.000		57.000		
Overhead (20 % of direct costs)			99.800		11.400		
Total			598.800		68.400		
4th calendar year 2008	Salaries/academic staff	6,5	235.000	0,5	27.000		
	Salaries/techn.-adm. staff	2,0	67.000	1,0	32.000		
	Equipment						
	Operational expenses		24.000				
	Others (please specify below)						
Total direct costs			326.000		59.000		
Overhead (20 % of direct costs)			65.200		11.800		
Total			391.200		70.800		
5th calendar year 2009	Salaries/academic staff	4,0	136.000	0,5	28.000		
	Salaries/techn.-adm. staff			1,0	33.000		
	Equipment						
	Operational expenses		10.000				
	Others (please specify below)						
Total direct costs			146.000		61.000		
Overhead (20 % of direct costs)			29.200		12.200		
Total			175.200		73.200		
6th calendar year 2010	Salaries/academic staff	1,0	51.000	0,5	29.000		
	Salaries/techn.-adm. staff			0,5	17.000		
	Equipment						
	Operational expenses		5.000				
	Others (please specify below)						
Total direct costs			56.000		46.000		
Overhead (20 % of direct costs)			11.200		9.200		
Total			67.200		55.200		
Total for the 5 years			1.860.000		333.600		

Budget for each participating institution — Name of institution: KVL, Eco							
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 2005	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 2006	Salaries/academic staff	10,0	370.000	1,0	50.000		
	Salaries/techn.-adm. staff			2,0	50.000		
	Equipment						
	Operational expenses						
	Others (please specify below)		50.000		10.000		
Total direct costs			420.000		110.000		
Overhead (20 % of direct costs)			84.000		22.000		
Total			504.000		132.000		
3rd calendar year 2007	Salaries/academic staff	12,0	456.000	1,0	52.000		
	Salaries/techn.-adm. staff			2,0	52.000		
	Equipment						
	Operational expenses						
	Others (please specify below)		70.000		10.000		
Total direct costs			526.000		114.000		
Overhead (20 % of direct costs)			105.000		22.800		
Total			631.200		136.800		
4th calendar year 2008	Salaries/academic staff	12,0	471.000	1,0	54.000		
	Salaries/techn.-adm. staff			2,0	54.000		
	Equipment						
	Operational expenses						
	Others (please specify below)		70.000		10.000		
Total direct costs			541.000		118.000		
Overhead (20 % of direct costs)			108.200		23.600		
Total			649.200		141.600		
5th calendar year 2009	Salaries/academic staff	6,0	244.500	1,0	56.000		
	Salaries/techn.-adm. staff			2,0	56.000		
	Equipment						
	Operational expenses						
	Others (please specify below)		60.000		10.000		
Total direct costs			304.500		122.000		
Overhead (20 % of direct costs)			60.900		24.400		
Total			365.400		146.400		
6th calendar year 2010	Salaries/academic staff	3,0	124.500	1,0	58.000		
	Salaries/techn.-adm. staff			2,0	58.000		
	Equipment						
	Operational expenses						
	Others (please specify below)		34.000		10.000		
Total direct costs			158.500		126.000		
Overhead (20 % of direct costs)			31.700		25.200		
Total			190.200		151.200		
Total for the 5 years			2.340.000		708.000		

11. Signatures:

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Name	Institute	Date	Signature
Project manager: Head of Research group Kristian Thorup-Kristensen	DIAS, Department of Horticulture	23/9-05	
Institute management: Head of department Ole Callesen	DIAS, Department of Horticulture	19/9-05	
Institute management: Head of department Henrik Andersen	DIAS, Department of Food Science	22/9.05	
Institute management: Head of Centre Peter Mose Larsen	University of Southern Denmark, Centre for Proteome Analysis	24/9-05	f. Peter Mose Larsen 
Institute management: Head of institute Jens Wolstrup	KVL, Department of Ecology	16/9-05	
Institute management: Head of institute Anna Haldrup	KVL, Department of Plant Biology	16/9-05	

12. Description of the project:

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