



## **Work Package 5.1. Economic and Multi-criteria Impact Assessment**

### **“Evaluating Resource Use in Low Input Systems”**

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### **Presentation Overview**

- *From defined production schemes to reference quality assurance schemes*
- *Multi-criteria assessment of reference schemes and incidence on breeding innovations: public goods and resource use*





## **1. Production Schemes identified in LIB project document**

- **Dairy Cows (p. 39)**

- Certified organic dairy production systems which follow EU-organic farming standards
- Non-organic 'low input' systems are either
  - (a) traditional grazing based systems (often located in mountainous areas of Europe)
  - (b) novel New Zealand-type low input/low cost systems (developed in some European regions due to decreasing milk prices and increasing input costs)

- **Sheep (p. 79)**

- Organically certified
- Traditional (:extensively outdoor reared)



- **Pigs (p. 110-111)**

- Non-organic 'low input' systems usually characterised:
  - by smaller herd size, more space per animal, lower capital investment, often outdoor management, provision of bedding, greater labor requirement and focus on animal welfare.
- Organic production systems have similar characteristics but with additional prescriptions as to stocking densities and access to outdoor runs, levels of 'bought in, non-organic' feeds and use of GM-feeds.

- **Laying Hens (p. 141)**

- Organically certified:
  - (a) maximum / minimum outdoor husbandry,
  - (b) using molting systems
- Non-organic free-range





## 2. Representative Sub-set Reference Schemes

- **Task 1 Working Package:**
  - “Identification of a representative set of quality assurance reference schemes for the evaluation of livestock production systems under the LIB project”
- **Criteria for workable set of production systems?**
  - Broad coverage of issues regarding animal welfare, pesticide use, climate change (forage), human health (antibiotics)
  - Identification of the systems we do want to evaluate and improve upon within the LIB project?
- **How?**
  - Drawing from the definitions of production schemes in LIB project
  - Stakeholder consultation: Workshop in Brussels, 26.05.11



## **DAIRY COWS - Reference Schemes**

<b>DAIRY COWS</b>	
<b>Organic</b>	Pasture Based (Grasslands)
	Mixed Systems (Silage and Pasture)
<b>Low Input</b>	Traditional Grazing Systems (Mountains)
	Low Cost Mixed Production (Grasslands: NZ)





**SHEEP- Reference Schemes**


<b>SHEEP</b>	
<b>Organic</b>	Pasture Based (Grasslands in mountains)
	Feed Self sufficient (mountains)
	Feed Self Sufficient (Plains)
<b>Low Input</b>	Pasture Based (Grasslands in mountains)
	Grazing systems with forage and lower concentrates (Plains)
	Mixed Systems (sheep+crop) Semi-extensive (plains)



**PIGS - Reference Schemes**

<b>PIGS</b>	
<b>Organic</b>	Pasture-Based with Maximal Outside Husbandry (fields)
	Concrete Based with Maximal Outside Husbandry (sows in fields and growing pigs on concrete with outdoor run)
	Concrete Based with Minimal Outside Husbandry (sows and growing pigs on concrete with outdoor run)
<b>Low Input</b>	Traditional Extensive Grazing (Medit.)
	Conventional Outdoor with minimal outside husbandry (fattening inside / breeding outside)
	Conventional Outdoor with maximal outside husbandry (fattening outside or deep straw / breeding outside)






### LAYING HENS - Reference Schemes

LAYING HENS	
<b>Organic</b>	Maximal Outside Husbandry (Large flocks, $\pm$ 15.000)
	Minimal Outside Husbandry (Small flocks, $\pm$ 3.000)
	With Extended Laying Period (up to 100 d. against throw outs)
<b>Low Input</b>	Free Range with Maximal Outside Husbandry
	Free Range with Minimal Outside Husbandry
	Free Range With Extended Laying Period

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### 3. Multi- Criteria Assessment Template

**Why an assessment?**


- **Cost-benefit analysis of LI and Organic production**
  - Price premium for various labelling and consumer information systems (e.g. organic label for animals, organic plus labels for others)
  - Subsidies for certain social welfare outputs of the production systems (e.g. for landscape preservation)
  - Model to calculate the profit margins under the various production systems and price premium scenarios
- **Assessment profit margins generated by improved breeds of LIB project**

LowInputBreeds



*Why an assessment?*

- *Cost-benefit analysis of LI and Organic production*
- **Assessment of profit margins generated by improved breeds resulting LIB project**
  - *Identify cases of improved organic or low input breeds for which there is evidence of both economic and societal benefits*
  - *Define measures to support rapid introduction of innovation in commercial practice*





**Assessment Template**

**Multi-Criteria Assessment Table**

- *Criteria drawn from literature and legislation review*
- *Consolidated through stakeholder consultation February - March 2010*


<b>ENVIRONMENTAL</b>	<b>Energy Efficiency / input efficiency</b>	Methane Emissions
		Carbon Dioxide Emissions
		Fuel Use
		Carbon sequestration potential
		Fertiliser Use
	<b>Biodiversity and Landscape Conservation</b>	Landscape preservation
		Water use and quality
		Soil nutrient richness
		Nitrogen capturing
		Open air pastures
<b>WELFARE, HEALTH AND QUALITY</b>	<b>Animal Welfare</b>	Mutilation prohibition
		Adaptive breeding
		Nutrition (balanced and organic)
		Disease prevention
		Veterinary treatment limitations
	<b>Public Health</b>	Pesticide residue
		Zoonotic Pathogens
	<b>Food Quality</b>	Antibiotic-Resistant Infections (MRSA)
		Sensorial (taste, cooking)
		Nutritional (vitamins, aminated acids)



*Dairy Cows Env.*

**DAIRY COWS: Environmental Impact**

*Expert Interviews: Filippo BISCARINI and Peter KLOCKE*




			CONV.	ORGANIC	LI	
<b>ENVIRONMENTAL</b>	<b>Energy / Input efficiency</b>	Methane Emissions	High	Low	Lower	
		<i>For emissions, measurement problem: per cow/herd or production liter? Results differ (conventional more efficient if production liters due to higher yields)</i>				
		Carbon Dioxide Emissions	High	Low	Lower	
		Fuel Use	High	Lower	Low	
		Carbon sequestration potential	Low	Higher	High	
		Fertiliser Use	No reduction (nitrogen) 380 kg/N/ha	Highly Reduced	Reduced 240 kg/N/ha	
		Landscape preservation	Low	Very high	High	
		Water use and quality	Good	Good	Good	
		Soil nutrient richness	Low	Very high	High	
		Nitrogen capturing	Low	High	Average	

LowInputBreeds





*Dairy Cows WHQ*

**DAIRY COWS : Welfare, Health and Quality**



			CONV.	ORGANIC	LI	
<b>WELFARE, HEALTH AND QUALITY</b>	<b>Animal Welfare</b>	Open air pastures	Average (10 per cent with open air pastures DE)	Very high	Very high (depends on regional conditions)	
		Mutilation prohibition	No (horn burning)	Yes	No (local practices, awareness)	
		Adaptive breeding	Not required by law but induced by private sector: functionality	Average	Average	Yes (bull semen purchases local markets)
		Nutrition (balanced and organic)	Average	High requirements	Average (too expensive to follow-up intakes)	
		Disease prevention	Same performance levels			
		Veterinary treatment limitations	Strong	Very strong	Strong	
	<b>Public Health</b>	Pesticide residue (importance of withdrawal time)	None (very strict controls)	High levels	Average levels	
		Zoonotic Pathogens: tuberculous, dysentery...	High risk (antibiotics use)	Lesser risks (homeopathy)	Lesser risks	
		Antibiotic-Resistant Infections (MRSA)	High risk (antibiotics use)	Low (homeopathy)	Lesser / average	
	<b>Food Quality</b>	Sensorial (taste, cooking)	Good	Good	Good	
		Nutritional (vitamins, amino acids)	Good	Higher	Good	


LowInputBreeds










**Sheep Env.**  
**SHEEP: Environmental Impact**  
*Experts: Marc BENOIT, Hervé HOSTE and Smagda SOTIRAKI*

		CONV.	ORGANIC	LI
Energy / Input efficiency	Methane Emissions	Correlation between ewe productivity and emissions if calculate per carcass ; different if calculated per product kg/liter (in parallel to dairy cows)		
	Carbon Dioxide Emissions	-	Leguminous valorisation	
	Fuel Use	Neg.	Very good, esp. if recourse to open air pastures	
	Carbon sequestration potential	High levels of surface use and density	Chemical fertilizer absent	Sequestration surface larger
	Fertiliser Use	Neg.	Excellent	Good
Biodiversity / Landscape	Landscape preservation	Less space but pastoralism	Extra efforts; excellent results	Less efficient than organic but still positive
	Water use and quality	Few irrigation efforts	No pesticide	Few pesticide
	Soil nutrient richness	Important losses	Less material losses but difficulties linked with exogenous fertiliser	
	Nitrogen capturing	Average (chemical fertilization)	Excellent, no spare wheel to search N	Real potential, few fertilizer per N

*Supp. Criteria: forage self-sufficiency and utilization of nitrogen (vis-à-vis fuel use); non-renewable energy consumption, pesticide use, resource allocation (milk, meat or wool) Need to take into account secondary effects related to indirect surfaces for concentrates' import (even more detrimental hidden effects)*





**Sheep WHQ**  
**SHEEP: Welfare, Health and Quality**

		CONV.	ORGANIC	LI
Animal Welfare	Open air pastures	Not mandatory but 95% include	Mandatory even for young (cause problems)	Automatic inclusion
	Mutilation prohibition	Castration etc... regional labels	Gen. prohibition exc. traditional	As conventional
	Adaptive breeding (very positive impact on results)	Industry pressure no rustic breeds	Mandatory in cahier charges	Needed since have to be robust (alone)
	Nutrition (balanced and organic)	Recommendation zootech. Class but average	Cahier des charges	As conventional
	Disease prevention	Punctual intervention	Cahier des charge (but problems with parasites)	As conventional
	Veterinary treatment limitations	No interdiction except specific labels	Limited antibiotics	As conventional
Public Health	Pesticide residue (importance of withdrawal time)			
	Zoonotic Pathogens: tuberculosis, dysentery... Antibiotic-Resistant Infections (MRSA)			
Food Quality	Sensorial (taste, cooking)	Better results than organic		
	Nutritional (vitamins, aminated acids)		Better results	

*Supp. Criteria: Additives use (more controlled in organic)*









**Pigs Env.**

**PIGS: Environmental Impact**

**Experts: Sandra EDWARDS and Jan MERKS**

		CONV.	ORGANIC	LI
<b>Energy / Input efficiency</b>	Methane Emissions (nitrogen more important?)	-	Reduction land use through reduced feed and lower protein levels: less emissions	
	Carbon Dioxide Emissions	-	-	
	Fuel Use	-	-	
	Carbon sequestration potential	-	-	
	Fertiliser Use (nitrogen)	-	Weakness of system: need rates below economical optimum for positive environmental impact	
<b>Biodiversity / Landscape</b>	Landscape preservation	-	-	
	Water use and quality	-	-	
	Soil nutrient richness	-	-	
	Nitrogen capturing	-	-	



*Farm management impacts more than production system: growth rate, feeding, pasture...  
Suppl. criteria: Feeding choice, feed production (conversion), manure management, concentrates use.*




**Pigs WHQ**

**PIGS: Welfare, Health and Quality**

		CONV.	ORGANIC	LI	
<b>HEALTH AND QUALITY</b>	<b>Animal Welfare</b>	Open air pastures			
		Mutilation prohibition			
		Adaptive breeding			
		Nutrition (balanced and organic)			
		Disease prevention			
	Veterinary treatment limitations				
	<b>Public Health</b>	Pesticide residue (importance of withdrawal time)		Outdoor rearing diminishes salmonella risks	
		Zoonotic Pathogens (Enteric)			
		Antibiotic-Resistant Infections (MRSA)			
		Sensorial (taste, cooking)	-	Grain and nutrient feeds improves intra-muscular fat content	
	Nutritional (vitamins, aminated acids)				







**Laying Hens Env.**

**LAYING HENS Environmental Impact**

**Experts: Ferry LEENSTRA and Veronika MAURER**

		CONV.	ORGANIC	LI: FREE RANGE
<b>Energy / Input efficiency</b>	Methane and Carbon Dioxide Emissions (not as important as for ruminants)	Low carbon footprint	Slightly less efficient	Slightly less efficient
	General Emissions (ammonia, dust N2O, CH4)	Low levels	Slightly less efficient	Slightly less efficient
	Fuel Use	Low levels	Slightly higher than LI	Slightly higher than conv.
	Carbon sequestration potential	Not really applicable in egg production		
	Fertiliser Use	Depends on ingredients feed: soy protein source low use, leguminoses high	Organic feeds: lower use than LI and conv.	Idem but N-efficiency lower, thus slightly higher use
<b>Biodiversity / Landscape</b>	Landscape preservation	Large-scale layer production (large houses): not add to landscape	Smaller flock size, thus more positive contribution	Large houses but grazing areas positive (not if merely open grassland)
	Water use and quality	Not much use except for feed, quality not affected even in closed system with manure collection	Risks of nitrate/phosphate pollution exist but reduced due to range area use restrictions	Risks of nitrate/phosphate pollution through droppings in range area
	Soil nutrient richness	Depends on application (duming) of manure but lower than LI or organic	High nitrate / phosphate levels in range area	High nitrate / phosphate levels in range area
	Nitrogen capturing	Allows for capturing (intensive housing)	Less than conventional since dropping cannot be handled, even harder than LI since small flock sizes	Less than conventional since dropping cannot be handled



**Supplementary criteria : Loss of nitrogen through N-related gasses (N2O and NOx)**



**Laying Hens WHQ**

**LAYING HENS : Welfare, Health and Quality**

		CONV.	ORGANIC	LI: FREE RANGE
<b>Animal Welfare</b>	Open air pastures	No requirement, neither in cages nor in barn housing	EU regulations, increased space leads to enriched environments	EU regulations, increased space leads to enriched environments
	Mutilation prohibition	None (but no real problems), except de-beaking in future	Mutilations not allowed, feather pecking problems (70 % flocks affected)	Idem as organic
	Adaptive breeding	Not in particular	Not in particular	Not in particular, but increase in barn housing push for free range heavier crosses
	Nutrition (balanced and organic)	Dietary composition same (vegetarian diet not natural), source different (percentage organic intake through EU regulations)	Idem, more parasites but better other parameters	Idem, vaccination and prohibition of outdoor access
	Disease prevention	Yes for NCD and Salmonella (vaccination)	Idem, but no preventive medication during rearing)	Idem to conventional
	Veterinary treatment limitations	Few treatments due to egg withdrawal time (except for extensive vaccination during rearing)	Idem, but no preventive medication during rearing)	Idem to conventional
<b>Public Health</b>	Pesticide residue (importance of withdrawal time)	No particular risk, regular checks	Idem but higher risk of dioxine contamination since outdoor area use	Idem but higher risk of dioxine contamination since outdoor area use
	Additives - Artificial Ingredients Use	None except for synthetic amino acids, vitamins, minerals and additions for yolk color	Idem, but no synthetic additive allowed	Idem as conventional
	Zoonotic Pathogens: tuberculosis, dysentery...	Salmonella	Idem	Idem (but routine vaccinations)
	Antibiotic-Resistant Infections (MRSA)	No antibiotic use due to withdrawal time	Idem	Idem
<b>Food Quality</b>	Sensorial (taste, cooking)	Shell quality	Idem	Idem
	Nutritional (vitamins, aminated acids)	Efforts to increase specific fatty acids vit. E and selenium concentration (through diet)	Idem	Idem


**Supplementary criteria : Space allowance inside / space allowance outside; hidden costs of feed production overseas**



***Concluding Remarks :***

**Preliminary results and most-representative variables choice**

**Thank you for you attention**

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