

IMAGO: Cost effective reduction of NH₃ emission in broiler houses

Gert-Jan Monteny

Presentation for UNECE meeting Prague, April 2006



ANIMAL SCIENCES GROUP
WAGENINGENUR

Background

- Working principle based on the PhD Thesis of Peter Groot Koerkamp
- Initially developed for drying litter in aviary housing systems
- Working principle based on recirculation of (warmed) indoor air over litter to evaporate water
- Additional floor heating (first 10 days) optional
- Now tested for application in broiler houses



The working principle of IMAGO

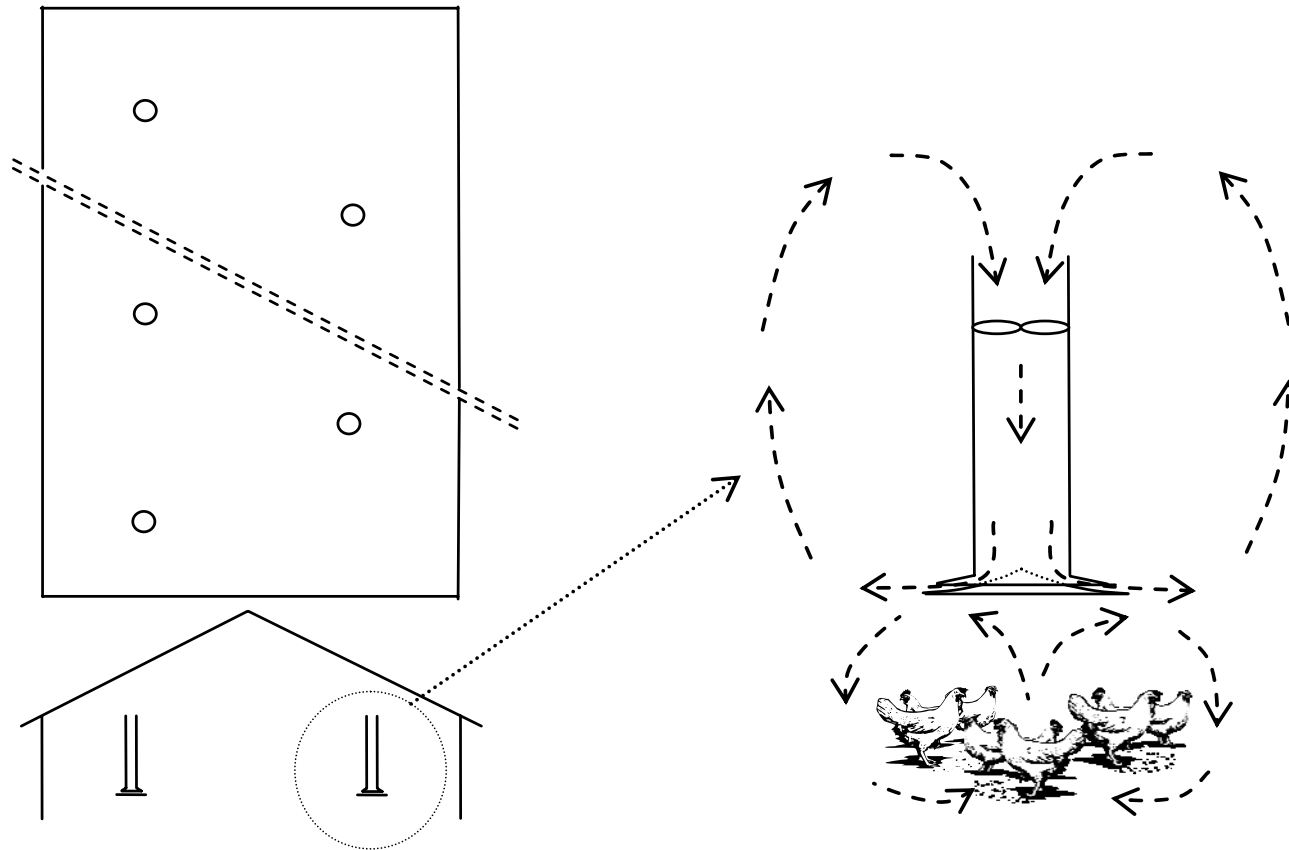
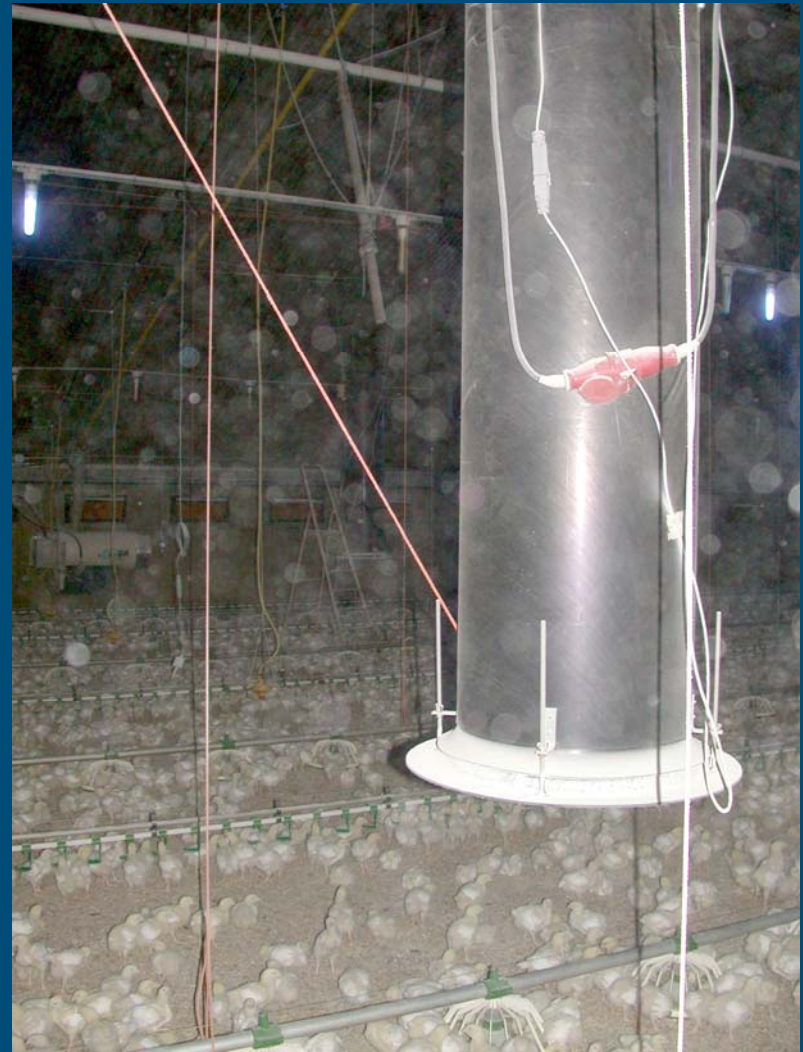


Figure 1. Schematic plan view (upper left), cross section (down left), detail of the shaft and air flow pattern (right)



The recirculation fans



Experimental set up

- Measurements in a mechanically ventilated broiler house in Assen (NL)
- Conventional emission measurements (measurement fan + convertor-NO_x analyser)
- 4 periods between 2002 and 2005
- Stocking density: 22.1 – 23.8 birds/m²
- Number of animals: 44,500 – 48,000 birds
- Additional odour measurements



Set up

Period	1	2	3	4	Norm
MM/YY	6-8 '02	10-11 '02	3-5 '05	6-8 '05	
Production (d)	41	38	41	40	43
Weight (g)	2,514	2,255	2,329	2,443	2,050
FCR (-)	1.50	1.55	1.58	1.69	1.75
Mortality (%)	2.4	5.9	4.8	3.4	4.2



Set up – cont'd

Period	1	2	3	4
MM/YY	6-8 '02	10-11 '02	3-5 '05	6-8 '05
T _{out} (oC)	21.6	11.6	13.2	19.7
RH _{indoor} (%)	69	65	58	65
Ventilation (m ³ /h.animal)	2.8	1.1	1.3	1.9
Recirculation	-	-	0.45	0.62



Results: ammonia emission

Period	1	2	3	4	Norm
MM/YY	6-8 '02	10-11 '02	3-5 '05	6-8 '05	
NH ₃ conc. (mg/m ³)	0.93	1.47	3.28	1.83	
NH ₃ emission (g/h)	78	69	266	214	
NH ₃ emission (g/y.bird; 81% annual occupation rate)	12.4	10.2	41.8	31.7	80



Main findings

- On average 70% lower than traditional
- But: variation 50 - 90%
- Climatic conditions and management matter
- Reduced length of production cycle and FCR
- Increased slaughter weight



Results: litter composition

Period	1	2	3	4
MM/YY	6-8 '02	10-11 '02	3-5 '05	6-8 '05
DM (g/kg)	586	617	-	-
TAN (g/kg)	3.7	3.5	-	-
Total N (g/kg)	32.9	31.8	-	-



Emission factor for the IMAG system

■ FCR 1.75

- Normative N excretion ('forfait') = 492 g/y.animal
- Emission Factor (% of N excreted): 1.7 – 7%
- Emission Factor traditional: 13.4%



Costs

Table 7. Costs of the ImagO system, excluding and including Dutch VAT of 19% on investments and 6% on feed calculated with different Feed Conversion Ratios (FCR).

		Costs per 100 broilers (€)	
		Excl. VAT	Incl. VAT
Investment		9.67	11.50
Operating energy		3.15	3.75
Heating energy		- 2.97	- 3.54
Feed	FCR 1.58	- 8.22	- 8.71
Net	FCR 1.75	9.84	11.71
	FCR 1.58	1.63	3.00



Conclusions

- Advanced drying of litter substantially reduced ammonia emissions
- Effective systems can be cheap, especially when additional revenues are realized (increased production results)
- Reduced ammonia emissions → more N in manure → less organic N applied to land (Nitrates Directive)
- Ag Engineering R&D can contribute to innovative economical and ecological sustainable solutions



Finally.....

THANKS

(Sorry, no nice picture of a broiler chick)



ANIMAL SCIENCES GROUP

WAGENINGENUR