

Environmental, Health and Socio-economic Risks Associated with Livestock Intensification



*Proceedings of the PRISE Scientific Committee
Thursday 4th December 2008
NIVR, National Institute of Veterinary Research
Hanoi, Vietnam*



Agricultural Publishing House

Vietnamese-French research consortium, PRISE was created in 2003 to assess the risks associated with the intensification of livestock production, and to propose technical solutions for sustainable intensification.



© PRISE, Proof-editing by Dominique Veltre, edited by C. Le Bas, Cirad, PRISE Coordinator 2007-2008

PCP PRISE, National Institute of Animal Husbandry (NIAH)

Thuy Phuong, Tu Liem, Hanoi

Tel: +84-4-3 757 0521

Fax: +84-4-3 757 2177

Email: prise.pcp@gmail.com

Website: <http://www.prise-pcp.org>

63-630

NN-2009

292/02-09

High Pathogenic Avian Influenza in Poultry Production Systems in Vietnam: TENTATIVE APPROACH FOR AN HACCP-LIKE RISK SCORING METHODOLOGY

C. Le Bas^{a,*}, Phan Dang Thang^b, S. Desvaux^a, Nguyen Van Duy^b, Nguyen Cong Oanh^b, Han Quang Hanh^b, J.-F. Renard^a, Vu Dinh Ton^b,

^aCIRAD, Campus International de Baillarguet, TA30/A, 34398 Montpellier Cedex 5, France

^bHAU, Hanoi Agriculture University, Center for Interdisciplinary Research on Rural Development, Trau Quy, Gia Lam, Hanoi, Vietnam

ABSTRACT

The circulation of the HPAI virus can be studied at farm level, but relevant data gathered at other points in the poultry production chain, such as markets or collection points, help create a clearer picture of the virus' circulation, since these points are often more accessible than the farms. There is also potential for the virus to become concentrated at these points. Observation of critical points along the chain should draw a good picture of the virus' circulation. Either this could be used as a comparison with farm survey data, or it could provide more efficient and rapid detection of HPAI in a given context and production sector.

The objectives of the present study are to analyze and describe flows and practices from the top to the bottom of the poultry marketing chain in two Provinces of North Vietnam to evaluate a HACCP-like risk scoring methodology and to identify critical points for the detection of pathogen circulation along these marketing chains.

The qualitative description of poultry production sectors was based on questionnaires compiled between May and August 2008 on 240 poultry semi-commercial production farms and 60 collective interviews of backyard producers and 60 traders in Ha Tay and Bac Giang Provinces. Possible observation points were identified. The HACCP-like approach with a risk scoring

methodology, tested on two points from the layer production sector, was able to discriminate between these two points. Our result confirms that this method could be used to identify a few critical observation points with a higher risk of virus circulation in the chain, where the early detection of HPAI virus would be most effective.

Keywords: High-Pathogenic Avian Influenza; Risk scoring; HACCP; Poultry production; Poultry traders; Chicken; Duck; Vietnam

INTRODUCTION

Poultry marketing chains converge to a single geographical point. Birds come in from many village farms in a given geographic zone to singular pool of markets and collection points. As these locations are more easily accessible than farms, they may be suitable points for observing the circulation of pathogens, such as high-pathogenic avian influenza virus, throughout the supply pool. The propensity of small farmers in developing countries to sell-off sick animals as a precautionary measure – even when faced with only a vague suspicion of risk, likely leads to a concentration of pathogenic prevalence that can be easily detected in poultry available at central markets-as compared to the likelihood of detecting such prevalence in poultry still being raised on farms. Therefore, inspecting certain key points along the marketing chain can create a

*Corresponding author. Campus international de Baillarguet - TA C-22 / E - 34398 Montpellier Cedex 5
Tél : +33 4 67 59 37 22 - Fax : +33 4 67 59 37 99 - E-mail address: cedric.le_bas@cirad.fr

more complete picture of pathogen circulation higher up the chain, at the level of small village farms. This will allow for the early detection of changes taking place. Marketing chains are also sources of viral diffusion risk, providing the opportunity for contact between the virus and humans along the path of commerce. The control and prevention of diffusion along these flows are the approaches most frequently mentioned, notably, using HACCP methods. But to employ these methods, one works down the chain in order to improve the final product.

Lastly, marketing chains generate diverse exchanges (people, fomites, cages, straw...) alongside the trade of birds, which represents yet another contamination risk for farms—both up and down the chain. Controlling these spatial diffusion risks is, therefore, indispensable.

The two objectives of the present study were to (i) analyze and describe the flows and practices from the top to the bottom of the poultry marketing chain in two Provinces of North Vietnam and (ii) evaluate an HACCP-like risk scoring methodology to identify particular critical points along these marketing chains for the early detection of pathogen circulation higher up the chain on small village farms.

MATERIAL AND METHODS

Questionnaires were completed in 6 communes in Hay Tay and Bac Giang Provinces in North Vietnam, between May and August 2008, on 240 semi-commercial poultry production farms. 60 collective interviews with backyard producers and 60 traders were also collected. Semi-commercial farms were defined as farms raising more than 200 birds per year, a "per batch" production and integrated to a commercial network. When possible, the traders were linked to the producers interviewed, following the snowball sampling principle. Information about farming practices, inflows and outflows, production cycles, buying and selling locations and behaviors, feeding, housing and practices for minimizing sanitary risks were collected.

The typology and qualitative description served as a basis for the identification of observation points (OP) in the production systems. The description of the OPs should provide a first estimation of the risk level at each point for each production system and should provide information about the Critical Observation Points (COPs) in the production chain, in analogy with the Critical Control Points in the HACCP method. Schematic diagrams of the production systems in the investigated area should help to identify the flows between the OPs with some quantitative information. The schematic diagrams were validated with an expert panel comprised of the main stakeholders' representatives, (producers, assemblers, hatcheries, traders and researchers).

A semi-quantitative risk assessment was tested on some OPs, in giving a score to the HPAI virus diffusion, multiplication, concentration or introduction risks for each OP. The scoring was based on the mean answers from the database and the expert panel to questions regarding the respective risks (Table 2). The scoring can be adapted to each objective. In this study, two possible objectives were investigated: identify the most suitable COPs (i) for a surveillance program of HPAI in a given production system and area, and (ii) for a representative observation of HPAI circulation, to be compared with a longitudinal study at farm level in the same production system.

RESULTS and DISCUSSION

Qualitative description of poultry production systems

We classified poultry farming systems by herd size and bio-security levels on the farms, as in Table 1.

Table 1. Typology of poultry production systems in Bac Giang and Ha Tay Provinces

Poultry production systems	Production sectors	Number of questionnaires	Percentage (%)
Semi-commercial with moderate to high bio-security	Layer production	24	8
	Meat chicken production	43	14
Semi-commercial with low to minimal bio-security	Meat duck/Muscovy duck production	30	10
	Layer duck/Muscovy duck production	60	20
	Mixed production	83	28
Village/backyard production with minimal bio-security		60	20
Total		300	100

Table 2. Number of poultry flocks in the production systems in Bac Giang and Ha Tay Provinces (heads/farm/year)

Type of poultry	Semi-commercial production sectors					Back-yard
	Layer hens	Meat chickens	Meat ducks	Layer ducks	Mixed	
Meat chickens	0 - 450	572	50	0 - 163	420	40
Layer hens	504	0 - 20	0 - 11	0 - 16	50	7
Meat ducks	0 - 105	0 - 88	1,182	1,618	1,050	0 - 35
Layer ducks	0 - 50	0 - 20	0 - 68	362	186	0 - 5
Meat Muscovy ducks	0	0 - 59	384	0 - 361	349	0 - 20
Layer Muscovy ducks	0 - 185	0 - 78	0 - 80	0 - 200	0 - 155	0 - 30
Others (geese, pigeons, day old chicks)	0	0 - 4,275	0 - 123	0 - 44	12	0 - 5

Semi-commercial poultry production sectors

Layer/reproduction hens and meat chicken production

Semi-commercial chicken farms are defined as having a moderate to high bio-security level with mainly confined and indoor production, industrial feeding and the use of one main poultry breed (Table 1).

Reproductive chicken farms maintain an average of 500 heads. The production timing only exploits one reproductive cycle of the hens. They are bred from April or

May and sold about from December to February of the following year.

Layer hen farmers often possess long experience and the bio-security levels maintained are moderate, with a higher disease prevention rate than that found in other production sectors. The birds are kept confined or have access to the outdoors, but they are kept out of contact with other domestic or wild bird types. Layer hens are regularly vaccinated, even during the reproduction period. Housing is regularly cleaned and disinfected. Feed is mainly of the industrial type sold by commercial agents to the farmers.



It is, however, difficult to rigorously separate the layer hen sector from reproductive poultry production sector, because the farmers don't really make the distinction themselves.

Semi-commercial meat chicken producers maintain an average of about 570 heads per farm per year (Table 2). Several farms do not specialize and are associated with other bird types. They have good facilities; with a private area for housing and an additional outdoor area. Usually 3 flocks are produced per year, with a production cycle of 4 months. The peak production period falls during the 4 months before the annual Tet events. There are lulls in production from February to March due to wet weather and a higher sensitivity to diseases and in July due to the hot weather.

On the heels of the avian influenza epidemic, the demand for day-old chicks has increased, leading to an increase in the production of layer hens. Day-old chicks are principally sourced from producers' own farms or from private incubators in the region, and less frequently from trading agents. Occasionally, the chicks come directly from private companies or research centres (Figures 1 and 2). Exceptionally, farmers buy day-old chicks from the markets.

Poultry eggs are mainly sold to incubators for hatching in the region (Figure 1 and 2), with a small part being sold at the communal market for consumers. Reform hens are mainly sold at the farm gate for wholesalers.

Despite the higher bio-security in this production sector, farmers usually treat the birds with antibiotics themselves when disease appears in the flock or as a preventive measure when an epidemic occurs in the region or neighborhood. Farmers also normally consume the birds even if they are dead or ill. They eventually use the carcasses for feeding dogs, pigs or fish.

Layer/reproduction duck, Muscovy duck production

As different bird species, including ducks,

Muscovy ducks and some chicken for family needs are often bred together outdoors on the rice fields with low vaccination rates, this production sector has a lower bio-security level, which we characterize as: "from minimal to low" (Table 1).

The breed of 'Super eggs' layer duck is often raised over a period of 2 years, while other layer duck breeds, like 'Super meat', 'Bau Canh Trang' and Muscovy ducks have a production cycle of 13-14 months. With the exception of the "Super meat" duck breed and the Muscovy ducks often raised around the canals and ponds near the farm, other breeds usually graze along the rivers, canals and rice field during the day, and are kept in the duck house at night.

Meat ducks are often raised on a short-term basis of about 2-3 months, from 2 to 4 flocks per year depending on the breed, but principally following the rice harvesting period, from April to June and from August to December. Duck production feed is mainly based, therefore, on rice-field by-products with industrial complements.

Complete vaccination programs are only executed for layer ducks and Muscovy ducks prior to the laying period.

When disease appears in this production sector, most of the farmers self-treat their flocks with antibiotics for 3 to 5 days. The rest scarily or slaughter the birds. When epidemics occur in the neighborhood, in addition to antibiotic treatments, farmers confine the ducks in the family area.

Ducklings are mainly bought from private egg hatching incubators and traders, less frequently from the poultry research centers (Figures 1 and 2).

Reform meat and layer ducks are mainly sold at farm gate for traders.

Duck and Muscovy duck eggs are incubated in private hatcheries. The eggs of the "Super Eggs" breed are sold to hatcheries for producing embryonic duck eggs. Small quantities of the eggs leave the hatcheries only to return to the farm as ducklings for flock renewal. Lower quality eggs are sold at the market or consumed within the family.

Some farms combine chicken and duck production. In these mixed production systems, the chickens are usually better vaccinated than the ducks. Contact between the birds is frequent, including interaction with wild birds or neighboring flocks.

Village or backyard production sector

This sector is characterized by the lowest bio-security level, which we define as "minimal". Here, we commonly see scavenging birds, almost no vaccination and frequent contact with all manner of other birds. The investment is very low and mostly local breeds are used. 93% of households raise poultry, mainly in backyard production settings. This is continuous production, usually comprised of 4 to 10 layer hens, a few layer ducks and some Muscovy ducks.

The main local breeds used are "Ri, Dong Cao local or Ho local" breeds, and crosses between local breeds and the "Luong Phuong" breed.

The majority of the households purchase ducklings or day-old chicks from the local market or produce their own day-old chicks. Less frequently, they buy from traders or from the private hatching incubator in the region.

Meat chickens are often kept for over 5 months, meat ducks about 2,2 months and meat Muscovy ducks over 3 months.

The flocks are vaccinated only during the H5N1 vaccination campaigns and only once or twice per flock. Farmers very rarely know about other vaccine types.

Behavior regarding disease on the farm is similar to other sectors, but few households call the local veterinary officer for killing and destroying the infected animals.

When an epidemic occurs in the region, most of the households slaughter their poultry and sell them to save their income. They usually don't use antibiotics to treat their birds.

The households mostly sell their birds

at the retail market or at the farm gate to traders when selling over 10 birds. But self-consumption is important in this sector, and usually more so for chicken than for ducks and Muscovy ducks.

A majority of households have reduced their poultry production in recent years because of the frequent epidemics and the increasing cost of animal feed.

Poultry markets (Figures 1 and 2)

Three main types of poultry markets were distinguished:

The specialized poultry markets: large markets trading only live poultry, the market in Ha Vy, Ha Tay province, is an example.

The commune and village markets: small markets where agents sell live poultry or carcasses directly to the consumers. Day-old chicks and ducklings are usually sold at the commune kermis markets.

Roadside markets: are for collecting live poultry from small producers.

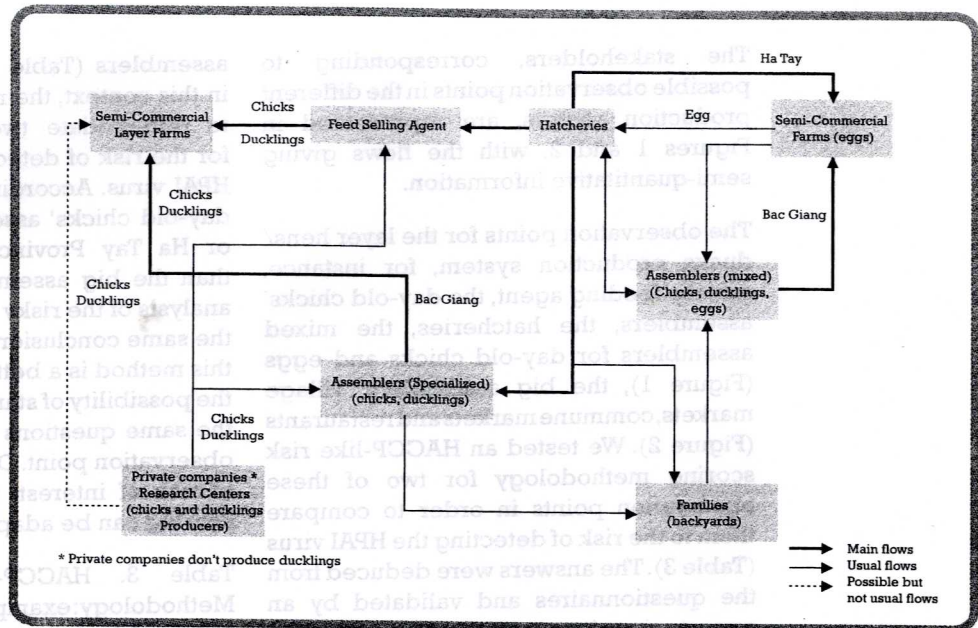


Figure 1: Schematic representation of the stakeholders (COPs) in the chicken and duck LAYER production chains in Bac Giang and Ha Tay Provinces: INFLOWS to semi-commercial broiler farms and backyard producers.

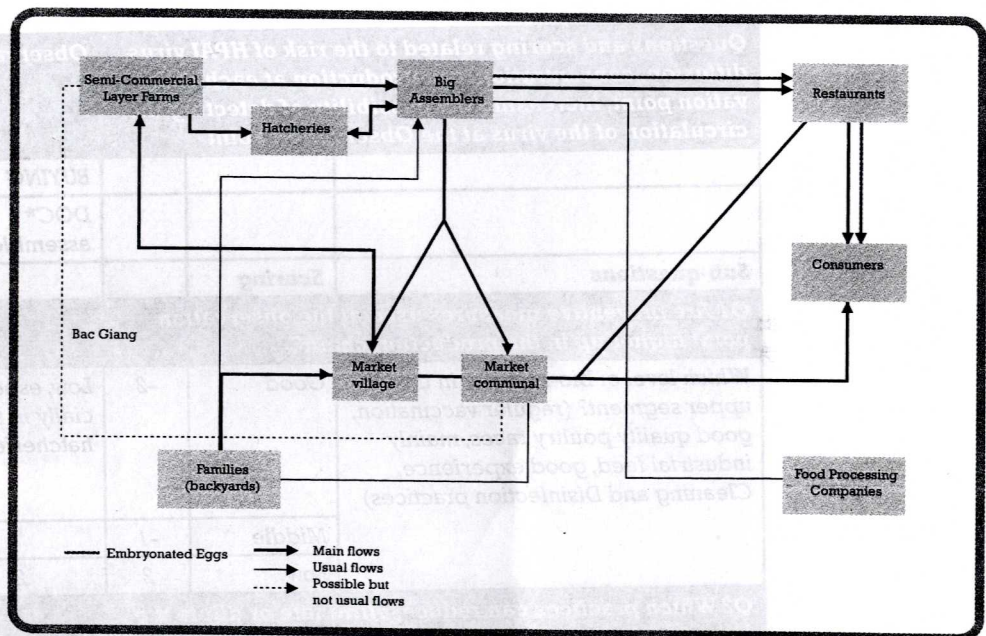


Figure 2: Schematic representation of the stakeholders (COPs) in the chicken and duck LAYER production chains in Bac Giang and Ha Tay Provinces: OUTFLOWS from semi-commercial layer farms and backyard producers.

The stakeholders, corresponding to possible observation points in the different production sectors, are represented in Figures 1 and 2, with the flows giving semi-quantitative information.

The observation points for the layer hens/ducks production system, for instance, are: the feeding agent, the day-old chicks' assemblers, the hatcheries, the mixed assemblers for day-old chicks and eggs (Figure 1), the big assemblers, village markets, commune markets and restaurants (Figure 2). We tested an HACCP-like risk scoring methodology for two of these observation points in order to compare them to the risk of detecting the HPAI virus (Table 3). The answers were deduced from the questionnaires and validated by an expert committee with representatives of the stakeholders in Bac Giang and Ha Tay Provinces.

The total score was 24 for the day-old chicks' assemblers and 10 for the big

assemblers (Table 3). This indicates that in this context, the methodology was able to differentiate two observation points for the risk of detecting the circulation of HPAI virus. According to this method, the day-old chicks' assemblers in Bac Giang or Ha Tay Provinces are more at risk than the big assemblers. The qualitative analysis of the risky practices can come to the same conclusion, but the advantage of this method is a better discrimination and the possibility of standardization, applying the same questions and scoring for each observation point. Depending on the type of risk of interest, the questions and/or scoring can be adapted.

Table 3. HACCP-Like Risk Scoring Methodology: example for two observation points of the layer hens/ducks production system (Figures 1 and 2)

Questions and scoring related to the risk of HPAI virus diffusion, concentration, or introduction at each observation point, increasing the possibility of detecting the circulation of the virus at the Observation Point			Observation Points Tested	
			BUYING	SELLING
			DOC* assembler	Big assembler
Sub-questions	Scoring			
Q1 Are preventive measures used at the observation point higher up in the production chain?				
Which level of bio-security in the upper segment? (regular vaccination, good quality poultry races, mainly industrial feed, good experience, Cleaning and Disinfection practices)	Good	-2	Low, especially in the hatcheries	Mixed origins from commercial farms and backyard production
	Middle	-1		-1
	Low	2	2	
Q2 Which practices can reduce, eliminate or dilute the virus at this observation point?				
Which level of bio-security at this segment? (regular vaccination, good quality poultry races, mainly industrial feed, good experience, Cleaning and Disinfection practices)	Good	-2		
	Middle	-1		
	Low	2	2	2



Mixing birds from low bio-security and higher bio-security farms <1 day (dilution)	Yes	-2	Usually kept more than one day together (possibility of virus diffusion)	Duck and chicken eggs kept one or two days together
	Sometimes	-1		-1
	no	0	0	
Q3 Which practices can increase the Introduction risk?				
Number of sources of buying?	1 type of stakeholder (ex Farmer, market, etc)	-1		
	2 to 5 types	1	Usually about 10 sources	Many sources, more than 10
	5-10 types	2	2	
	>10 types	3		3
Range of purchase area?	Commune level?	-1		
	District?	1		1
	Province?	2	Various Provinces and China	
	Buying from abroad (China, etc)?	5	5	
Sometimes buying from places where sanitary problems (sick/dead birds, etc)?			Diseased DOC are sometimes bought cheaper and then treated	
	Yes	3	3	
	Occasionally	1		1
	No	0		
Unsold birds?			Raised until sold	
	Yes	3	3	
	No	0		0
Other factors: Transport/Housing (closed, open), etc	Good conditions	-1		
	Middle	1		
	Bad	2	2	2

Q4 Which practices can increase the concentration risk?				
<i>Mixing birds of different sources/ species/ages >1day</i>	Yes	2	2	
	Sometimes	1		1
	No	0		
<i>Gathering and trading mainly lowest price, sick, and dead birds?</i>	Yes	2	2	
	No	0		0
<i>Transport (stress conditions?)</i>	Good	0	0	0
	Middle	1	1	
	Bad	2		2
Total Risk Scoring				
*DOC, Day-old Chicks				

The reliability of this semi-quantitative method of risk scoring depends mostly on the pertinence of the questions regarding risk practices at different observation points. Our questions were derived in part, from literature (2006), and mainly from the field questionnaires and experience-allowing a good understanding of the practices in the area considered.

ACKNOWLEDGMENTS

The French Ministry of Foreign Affairs funded this study within the framework of the GRIPAVI project. The authors would like to extend thanks for the participation of the Provincial and communal authorities, the stakeholders of the poultry production chains and all the staff involved in CIRAD, AGIR's team, and the CIRRD team at Hanoi Agriculture University.

REFERENCES

(2006) The Impact of Avian Influenza on Poultry Sector Restructuring and its Socio-economic Effects. Poultry Sector Rehabilitation Project – Phase I: Agrifood Consulting International.