# Impacts of Avian Influenza outbreaks on indigenous chicken genetic resources in Thailand

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## ABBREVIATIONS

| | |
|---|---|
| AI | Avian Influenza |
| Bht | Thai Baht, 1 US Dollar (USD) ≈ 39.9 Thai Baht |
| FAO | Food and Agriculture Organization |
| HPAI | High Pathogenic Avian Influenza |
| Rai | 1 Rai = 1600 $m^2$ |

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# PREFACE

The preparation of this report was part of the activities for the FAO project "Future prospects for the contribution of village poultry production to food security in developing Asian economies" (GCP/RAS/228/GER) that was funded by the "Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (GTZ)". The production systems of small poultry producers show a significant variety from very low input systems with scavenging birds to those with improved genetic resources, supplementary feeding and animal health interventions. In many countries the exact type of poultry used in the small production systems is presently not well understood. Investigating how local birds are affected by disease outbreaks will help to understand potential specific characteristics of the genetic resources. A good understanding of the production systems of small poultry producers including their priorities and constraints is also required to design and implement appropriate control strategies for the small poultry producers. This will help to achieve cooperation and proper involvement of small farmers in disease prevention and control programmes. It will also assist Governments to make appropriate plans for designing and implementing their disease control strategies. The present report summarizes information about the chicken production systems in three regions of Thailand. It is based on field investigations with selected producers in these districts. We hope it will provide accurate and useful information to its readers and any feedback is welcome by the authors and the Animal Production Service (AGAP)[1] of the Food and Agriculture Organization of the United Nations (FAO).

## Disclaimer



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## Keywords

*Poultry Management, Poultry breeds, Marketing, Disease control, Poultry and Culture*

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# EXECUTIVE SUMMARY

A survey was carried out to investigate the impact of AI outbreaks on Thai indigenous chicken genetic resources and genetic diversity. The survey covered 482 household in the Phitsanulok, Nakhon Phanom, and Suphan Buri & Nakhornpathom provinces representing the North, Northeast, and Central regions of Thailand. In each region the survey included 7-12 villages and 140-180 households. All villages in this study had at least one AI outbreak but in Supan Buri some villages up to 10 and most households had losses from disease or cullings. In addition to culling, Government interventions included payment of compensation and spraying with disinfectants.

Thai indigenous chickens are being raised for several purposes. Home consumption, sales when cash is needed or the flock is getting too big, and keeping fighting cocks were the main reasons. For a very similar proportion of the respondents the first priority of keeping chickens was for home consumption (37.0 percent) or keeping fighting cocks (34.1 percent). In the Northeast Thai indigenous chicken also play a role in religious or traditional ceremonies.

After the AI outbreaks most respondents restarted chicken production with restocking of indigenous chicken from the local areas, but in the Central region most likely also with chickens from various external sources. About 45 percent of the interviewees decreased the number of their chickens but few stopped completely. Another 40 percent maintained the same numbers and 15 percent had increased their flock size. Main reasons for reducing flock size were concerns about AI and a government policy that restricted restocking in some areas other reasons including need for better infrastucture and semi-modern housing. Main reasons for increasing were confidence in several management improvements, and the increasing demand for indigenous chickens as healthy/organic products. Only few producers brought significant management changes to their flocks. The most noticeable change of farmers' practices after AI outbreak was the eagerness to report sick chickens to village leader and to use local medicinal plants for disease protection or health improvement.

The diversity of Thai indigenous chickens was studied by using the Thai indigenous chicken guideline. Thai indigenous chicken strains are classified by feather colour into black (pradu), yellow, red, white, green, grey, bronze, and stripe types. The more common rooster strains in all regions of Thailand are the black and yellow types. The results of the study indicate that the AI outbreaks had an impact on the proportion of the different types of Thai indigenous chickens.

A total of 679 mature and 387 young roosters were photographed and then classified for back feather colour, shank colour, and comb types. Red was the most common back feather of Thai indigenous chicken (>50 percent). Black, yellow and straw colours were commonly found in young roosters, while the white colour was rarely found in both mature and young roosters. Yellow or yellow with black spot are the most common shank colours of Thai indigenous chicken (>80 percent). Pure black shanks are typical for the pure Black or Pradu strain and were found in less than 10 percent of the samples and white shanks representing the pure White strain were also found in less than 1 percent of the sample. The most common comb type was the pea comb (61 percent of mature and 79 percent of young roosters). The rock comb was another common comb type of the Thai indigenous chickens which has not been identified in any commercial type of chickens.

Prediction of mature weight of Thai indigenous chicken was tested with several mathematical equations, such as exponential, polynomial, logarithm. The best prediction equation was $MW = 1.482*AGE^{0.2308}$ ($R^2$ = 74.09%), where MW is the mature weight of the rooster and AGE is the age in month. The Thai indigenous roosters in Suphan Buri (Central) were slightly heavier than the average trend line, while those in Nakhon Phanom (Northeast) were slightly lower than the average trend line. The average mature weight of Thai indigenous chicken roosters was estimated to be close to 3.5 kg at 3 years of age.

The study indicates that the proportion of specific Thai indigenous stains is diminishing while mixed strains are increasing. Specific conservation measures are recommended to maintain the full range of Thai indigenous chicken strains.

# BACKGROUND

Bird flu or Avian Influenza (AI), caused by the Orthomyxovirus type A virus (Swayne, 2000), has a remarkably high mortality rate in a variety of wild and domestic bird species. H5N1 Highly Pathogenic Avian Influenza caused drastic losses to poultry farming throughout the world as well as in Thailand. The first report of a bird flu incidence in Thailand came on 23 January 2004 from the Suphan Buri province in central Thailand (OIE, 2005). Later there were three periods of outbreaks which totally affected 51 provinces all over the country except in the south. In an effort to curb the spread of the virus, Thailand has slaughtered 65 million chickens (DLD, 2005). Furthermore, H5N1 infections were also reported in a cat and in humans. From 2004 until 18 March 2008 there were a total number of 25 human cases affected by the Avian Influenza A/H5N1 of which 17 died (WHO, 2008). The severe losses of commercial chicken both broilers and layers caused a massive economic loss.

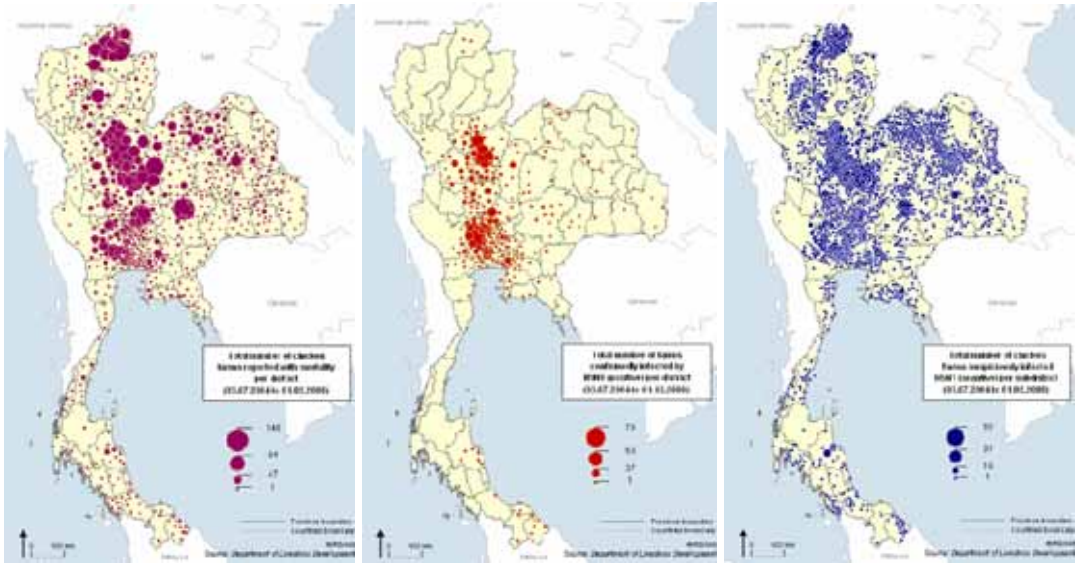
The culling of suspicious birds and all chickens within a radius of 5km from the centre of H5N1 infections was a drastic government policy. This policy not only destroyed commercial chickens but also to a large extend Thai Indigenous chickens throughout the country. The extent of chicken farms reporting mortality, confirmed infections and suspicion of infections during 2004-2008 is shown by Figure 1. The respective information for farms with Thai indigenous chicken (including fighting cock) is shown by Figure 2. All chickens in the farm with suspicion of infections were also culled.

It is well known that indigenous and local animals significantly contribute to a sustainable biodiversity. There was concern that the HPAI outbreaks and the related loss of Thai Indigenous chicken throughout the country (Figure 2) might have caused a serious loss of genetic diversity for the Thai indigenous chickens. That aspect was therefore an important issue but no diligent information was reported about the impacts of HPAI and its control measures on the genetic diversity and genetic resources.

## OBJECTIVES OF THE STUDY

The main objective of this study was to investigate the impact of HPAI outbreaks on Thai indigenous chicken genetic resources and the genetic diversity after the disease outbreaks.

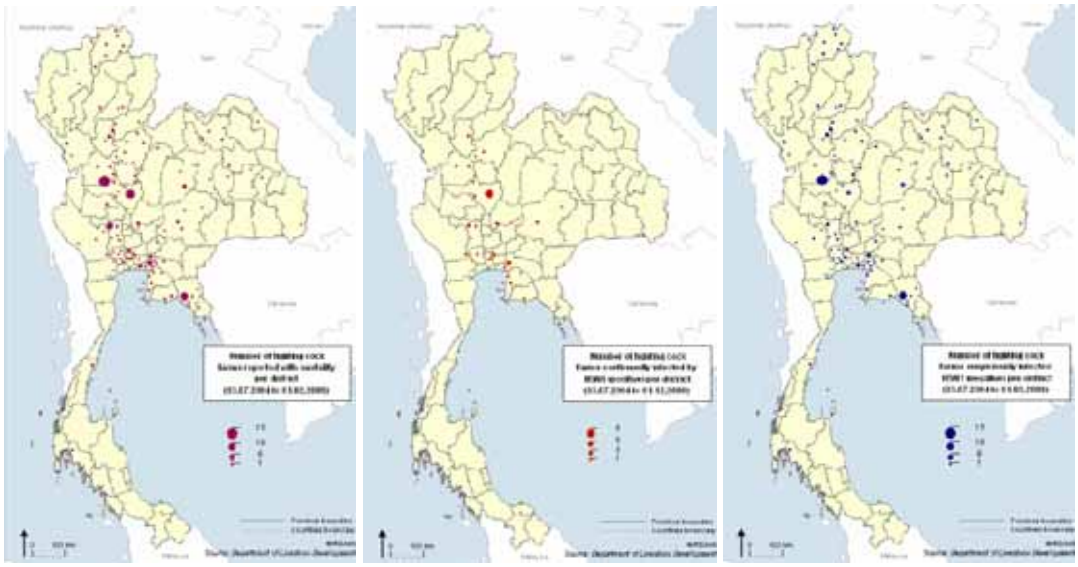
**Figure 1 Total number of chicken farms reporting mortality (a), confirmed infections (b) and suspicion of infections(c) with H5N1 during 2004-2008**



(a) (b) (c)

Source: http://www.rsgis.ait.ac.th

***Figure 2 Total numbers of Thai Indigenous chicken farms and households reporting mortality (a), confirmed infections (b) and suspicion of infections (c) with H5N1during 2004-2008.***



(a) (b) (c)

Source: http://www.rsgis.ait.ac.th

# SITE SELECTION AND DATA SURVEY

## SITE SELECTION

Three sites in the provinces of Phitsanulok, Nakhon Phanom, and Suphan Buri & Nakon Pathom, which represent the North, Northeast, and Central areas of Thailand, were chosen for surveys that were conducted during March-April 2009. Information about village and household data was collected by using three questionnaires (see Q1, Q2, Q3 in Appendix III) that were designed and agreed by the research team. For the investigation only household from districts with HPAI disease outbreaks during the past five years were chosen. Details about the locations, number of households surveyed and number of chickens recorded are summarized in Table 1 and the locations shown by the Figure 3.

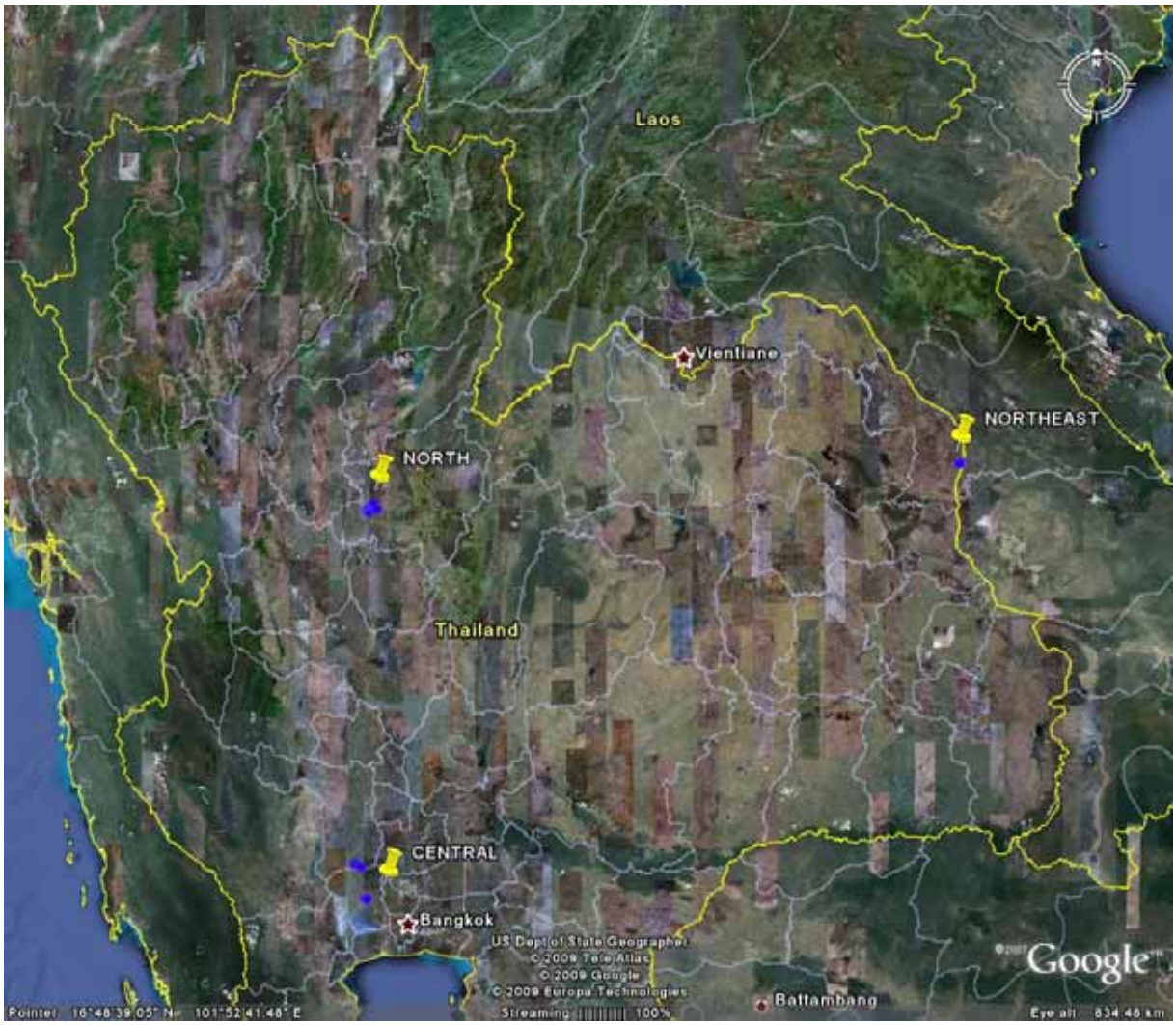
The village leaders were interviewed with the Q1 questionnaire to collect general information about the village and about the impacts of the Avian Influenza outbreaks for the entire community.

Household heads raising native chickens were interviewed with the Q2 and Q3 to collect details about the impact of AI outbreak on chicken raising procedures, and on the variety and numbers of chickens in the households. The household interviews covered several topics including management, housing, genetic diversity, poultry health, mortalities, the decision making about restocking and its priorities as well as strategies for protecting chickens from disease after having experienced chicken death from HPAI or culling. In each household a representative sample of young and mature roosters was weighed photos were taken to document the diversity of native chickens.

***Table 1 Number of districts, villages and households surveyed and chickens recorded and photographed***

| Characteristic | Phitsanulok (North) | Nakhon Phanom (Northeast) | Suphan Buri & Nakon Pathom (Central) | Total |
|---|---|---|---|---|
| Districts/ Subdistricts | 2/3 | 1/1 | 2/3 | 5 / 7 |
| Villages | 12 | 8 | 7 | 27 |
| Households | 170 | 154 | 162 | 486 |
| Chickens characterized | 353 | 243 | 472 | 1068 |
| Chickens weighed | 344 | 243 | 469 | 1056 |
| Pictures taken | 245 | 232 | 459 | 936 |

***Figure 3 Location of survey sites and selected farms***




## TRAINING FOR DATA COLLECTION

The same questionnaire and data collecting method was used for the three sites. The use of the questionnaires and the data collecting methods were first discussed among the researcher team and then precise training was given to the teams of the survey assistants from each site before the start of the field work. The questionnaires were pre-tested and modification or adjustment of the questionnaire discussed and approved by the team leader of the project.

## DATA SURVEY

The surveys were carried out for all three sites from March until early April 2009. First the village leaders were interviewed with Q1 then household heads with Q2-Q3. The interviewees were asked about the chicken diversity of lost and restocked chickens by using a set of sample pictures showing the different types of Thai indigenous chickens (see Appendix III, Q3). Young and mature roosters were weighed and photographed and pictures were also taken of village and household environments, chicken housing. All collected data and pictures were recorded in a MS Access database system.

## GENERAL INFORMATION

Details of twenty surveyed villages from five districts, representing the three areas North, Northeast and Central of Thailand are given in the Tables 2-5. On average 24.9 households per village were interviewed. The largest family size was found in the Northwest but lower numbers of family members in the central and northern parts of Thailand. The average numbers of household members for the North, Central, and Northeast were 3.13, 4.06, and 4.72, respectively. The proportion of household raising native chicken varied for the villages from 10-90 percent. The average number of households with native chickens for the North, Central, and Northeast regions was 38.45 percent, 18.25 percent and 49.93 percent, respectively.

Rice is a major crop for all areas of this study, while fruits, such as mango and banana, were found in Phitsanulok. Some vegetables are grown in the villages in the Central regions (Suphan Buri and Nakon Pathom), while they are common in the Northeast (Nakhon Phanom). In general cattle, chickens, and pigs are the main livestock in all survey villages.

Approximate one-third of all surveyed villages had veterinarians within their village. The maximum number of veterinary product stores was two per village however only 14 percent of all villages had any store indicating that animal health and disease prevention was inadequate. Government or village leaders still play the major role in promoting animal health management and prevention programs.

## IMPACT OF AI OUTBREAK

The available information and the survey revealed that the AI outbreaks in Thailand began from the Central (2004), then spread to the North (2005), and the Northeast (2006). The outbreak in 2005 that affected the North, started at Phitsanulok province. All studied villages had at least one incident of AI outbreaks. In Suphan Buri there were villages with up to 10 HPAI outbreaks per village. The culling of chickens affected most household but the numbers of culled chickens and the amount of compensation that was paid varied. The compensation for culling ranged from 40-70 baht/head of chicken. Every village had spray interventions during the year of the outbreak, and then up to now as a policy at least once a year. The government policy regarding spray invention is not uniform. In Phitsanulok (North), the spraying was carried out only once a year and only during a year with an AI outbreak. In Nakhon Phanom (Northeast), spraying was done at least three times in a year with an AI outbreak. The interviews showed that the perception of the village leaders is the key factor for a success of preventive animal health measures.

***Table 2 Information about the surveyed villages in Phitsanulok province (I)***

| | Village Name | | | | | |
|---|---|---|---|---|---|---|
| | Krang Nua | Yom Rat | Mab Moo | Hua Tae | Lam Po | Ta Wua |
| Tamboon | Ban Krang | Ta Nangam | | Ban Krang | | |
| District | Muang | Bangrakam | | Muang | | |
| Households interviewed | 18 | 14 | 31 | 15 | 31 | 3 |
| No of households | 218 | 132 | 610 | 164 | 367 | 191 |
| No of village members | 668 | 339 | 1 600 | 563 | 1 145 | 638 |
| Avg members/household | 3.1 | 2.6 | 2.6 | 3.4 | 3.1 | 3.3 |
| Households with native chicken | 25 | 121 | 426 | 80 | 300 | 40 |
| % with native chicken | 11.5 | 91.7 | 69.8 | 48.8 | 81.7 | 20.9 |
| Households with other chicken | | 1 | | | | |
| Total village area (rai) | 350 | 3 500 | 3 000 | 5 490 | 5 000 | 1 600 |
| Agricultural area(rai) | | 3 000 | 2 500 | 3 090 | 4 000 | 1 400 |
| Main field crops | Mango | Mango Banana | Rice, Mango | Rice | Rice, Vegetable, Banana | Rice |
| Main livestock | Cattle, Chicken, Geese | Cattle, Chicken, Pigs | Cattle, Chicken, Pigs | Cattle, Chicken, Pigs | Buffaloes, Cattle, Chicken, Pigs | Cattle, Chicken |
| Number of local veterinarians | - | 1 | 1 | 2 | - | - |
| Number of veterinary product stores | - | - | 1 | - | - | 1 |
| Number of feedstuff stores | 1 | 2 | 1 | - | - | 1 |
| Number of HPAI outbreaks | 1 (2005) | 1 (2004) | 1 (2004) | 3 (2004-2005) | 2 (2005-2007) | 2 (2005-2006) |
| No. of household with destroyed chickens | All | All | All | 120 | 323 | 40 |
| No culled chickens | | | 5 000 | 1 360 | 10 700 | 200 |
| Amount of compensation bht/chicken | 40 | 40 | 40 | 40 | 40 | 40 |
| Number of spray inventions | 1 (2005) | 11 (2004-2009) | 4 (2006-2009) | 6 (2004-2006) | 2 (2005, 2007) | 1 (2004) |

***Table 3 Information about the surveyed villages in Phitsanulok province (II)***

| | Village Name | | | | | |
|---|---|---|---|---|---|---|
| | Krang Nam | Wang Paya | Nong Pling | Na Chak Wai | Yan Yai | Bang Payom |
| Tamboon | Ban Kran | | | Ta Nangam | | Plaichumpon |
| District | Muang | | | Bangrakam | | Muang |
| Households interviewed | 20 | 10 | 8 | 11 | 9 | 22 |
| No of households | 382 | 537 | 87 | 105 | 135 | 900 |
| No of village members | 1 147 | 1 439 | 350 | 380 | 540 | 1 948 |
| Avg.members/household | 3.0 | 2.7 | 4.0 | 3.6 | 4.0 | 2.2 |
| Households with native chicken | 10 | | 20 | 50 | 30 | 29 |
| % with native chicken | 2.6 | | 22.9 | 47.6 | 22.2 | 3.2 |
| Households with other chicken | - | - | - | - | - | - |
| Total village area (rai) | 2 800 | | 1 774 | 2 800 | 4 500 | 4 375 |
| Agricultural area(rai) | 2 200 | | 1 600 | 2 500 | 4 000 | 1 100 |
| Main field crops | Rice | Mango, Banana | Rice, Mango, Lemon | Rice, Banana, Mango | | Rice, Corn, Mango |
| Main livestock | Cattle, Chicken, Pigs | Cattle, Chicken, Pigs | Chicken, Pigs | Cattle, Chicken, Pigs | | Cattle, Chicken, |
| Number of local veterinarians | - | - | 1 | 2 | 2 | - |
| Number of veterinary product stores | 1 | 1 | - | - | - | - |
| Number of feed stuff stores | - | - | 1 | - | - | - |
| Number of HPAI outbreaks | 1 (2005) | 1 (2004) | 1 (2004) | 1 (2006) | 2 (2004) | 1 (2004) |
| No. of household with destroyed chickens | All | All | All | All | 10 | All |
| No culled chickens | | | | 1,360 | 150 | 780 |
| Amount of compensation bht/chicken | 40 | 40 | 40 | 40 | 40 | 40 |
| Number of spray inventions | 1 (2005) | | | 1 (2006) | 3 (2004-2006) | |

***Table 4 Information about the surveyed villages in Nakhon Phanom province***

| | Village Name | | | | | | |
|---|---|---|---|---|---|---|---|
| | Klang Yai 3 | Klang Yai 4 | Dong Tue 5 | Dong Tue 6 | Dong Tue 9 | Klang Yai 10 | Dong Tue 12 |
| Tamboon | | | | Ban Klang | | | |
| District | | | | Muang | | | |
| Households interviewed | 8 | 16 | 18 | 26 | 43 | 20 | 6 |
| No of households | 118 | 135 | 133 | 126 | 123 | 212 | 148 |
| No of village members | 610 | 622 | 667 | 604 | 607 | 815 | 797 |
| Avg members/household | 5.2 | 4.6 | 5.0 | 4.8 | 4.9 | 3.8 | 5.4 |
| Households with native chicken | 20 | 18 | 60 | 30 | 53 | 21 | 22 |
| % with native chicken | 16.9 | 13.3 | 12.0 | 23.8 | 43.1 | 9.9 | 14.9 |
| Households with other chicken | 0 | 0 | 0 | 0 | 0 | 8 | 0 |
| Total village area (rai) | 230 | 807 | 199 | 310 | 750 | 789 | 320 |
| Agricultural area(rai) | 580 | 751 | 2 260 | 1 500 | 650 | 257 | 2 111 |
| Main field crops | Rice shallot | Rice pepper shallot | Rice corn pepper | Rice longbean tomato corn | Rice corn pepper longbean | Rice pepper corn | Rice corn pepper tomato |
| Main livestock | Chicken cattle pig | Chicken cattle | Cattle chicken | Chicken cattle pig | Chicken cattle | Chicken cattle pig | Chicken cattle, pig |
| Number of local veterinarians | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of veterinary product stores | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of feed stuff stores | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of outbreaks | 1 (2006) | 1 (2006) | 1 (2006) | 1 (2006) | 1 (2006) | 1 (2006) | 1 (2006) |
| No. of household with destroyed chickens | 40 | 17 | 40 | 35 | 45 | | 50 |
| No culled chickens | 250 | | 250 | | 200 | | 200 |
| Amount of compensation bht/village | 16 875 | | 16 875 | | 9 000 | | 9 000 |
| Number of spray inventions | 12 (2006-2009) | 8 (2006-2009) | 8 (2006-2009) | 12 (2006-2009) | 12 (2006-2009) | 8 (2006-2009) | 8 (2006-2009) |

***Table 5 Information about the surveyed villages in Suphan Buri and Nakon Pathom provinces***

| | Village Name | | | | | | |
|---|---|---|---|---|---|---|---|
| | Bang Sam | Ban Luang | Phai Chong Lom | Fang Klong | Lad Plee | Nong Kra Pi 4 | Nong Kra Pi 5 |
| Tamboon | Bang Lane | | | | | | |
| District | Bang Lane | Don Toom | Song Pi Nong | Don Toom | Song Pi Nong | Don Toom | |
| Households interviewed | 21 | 26 | 20 | 28 | 21 | 27 | 19 |
| No of households | 297 | 150 | 152 | 218 | 150 | 167 | 150 |
| No of village members | 1100 | 699 | 650 | | | 765 | 450 |
| Avg members/household | 3.7 | 4.7 | 4.3 | | | 4.6 | 3.0 |
| Households with native chicken | 30 | 50 | 80 | 197 | 80 | 10 | |
| % with native chicken | 10.1 | 33.3 | 52.6 | 90.4 | 53.3 | 59.9 | |
| Households with other chicken | 2 | | 7 | 1 | 20 | | |
| Total village area (rai) | 800 | | 2 000 | 2 000 | 2 600 | | |
| Agricultural area(rai) | 300 | | 300 | 1500 | 1500 | | |
| Main field crops | Rice vegetable | Rice jasmine | Rice | Rice vegetable | Rice lotus | Flower | Flower |
| Main livestock | Chicken | Chicken | Chicken | Chicken cattle | Layer, native chicken | Chicken | Pig cattle |
| Number of local veterinarians | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Number of veterinary product stores | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of feed stuff stores | 2 | 1 | 0 | 0 | 0 | 2 | 0 |
| Number of HPAI outbreaks | 1 (2004) | 1 (2004) | 1 (2006) | 1 (2004) | 10 (2004) | 1 (2004) | 1 (2004) |
| No. of household with destroyed chickens | 2 | | 7 | 91 | 80 | | |
| No culled chickens | | | 30 000 | 70 000 | 50 000 | | |
| Amount of compensation bht/chicken | | | 140/hd | 70/hd | 140/hd | | |
| Number of spray inventions | 14 (2004-2009) | 2 (2007,2008) | 15 (2006-2009) | 15 (2004-2008) | 7 (2004-2009) | 18 (2004-2008) | 2 (2004) |

# HOUSEHOLD DATA ANALYSIS

## REASONS FOR RAISING THAI INDIGENOUS CHICKENS

The answers from the 486 interviewed households show that Thai indigenous chickens are being raised for several purposes. Home consumption, sales when cash is needed or the flock gets too large, and for fighting cocks were the main reasons for most areas. The figures in Table 6 show that keeping chickens for raising fighting cocks was more popular in the North and Central Thailand than in the Northeast. Keeping them as a companion or for pleasure was more important for the farmers in the Northeast. The importance of Thai indigenous chicken for religious purposes or traditional ceremonies was more important in the Northeast than in other parts of Thailand.

***Table 6 Reason to raise Thai indigenous chicken in three regions of Thailand (percentage of respondents)***

| Purpose | Northeast (N=154) | North (N=170) | Central (N=162) |
|---|---|---|---|
| Home consumption | 94.8% | 71.8% | 74.7% |
| Sale when cash is needed | 59.1% | 74.1% | 4.9% |
| Sale when flock gets too large | 68.2% | 60.0% | 74.7% |
| Companion/pleasure | 64.3% | 54.1% | 13.0% |
| Ceremony/religious | 48.1% | 27.1% | 4.3% |
| Fighting cocks | 45.5% | 78.2% | 67.3% |

The first priority for raising Thai indigenous is shown in Table 7. Overall, the largest numbers of respondents have home consumption (37.0%) as the first priority for chicken raising but closely followed by keeping them for rearing fighting cocks (34.1%). There are however clear differences of priority for keeping chickens between the three surveyed regions of Thailand. This study revealed that the major priorities for raising Thai indigenous chicken for community in the Northeast, North and Central were home consumption (68.9%), fighting cocks (58.3%), and sale (44.6%), respectively.

***Table 7 First priority to raise Thai indigenous chicken in three regions of Thailand (percentage of respondents)***

| Purpose | Northeast (N=148) | North (N=144) | Central (N=157) | Overall (N=449) |
|---|---|---|---|---|
| Home consumption | 68.9% | 16.7% | 25.5% | 37.0% |
| Fighting cocks | 18.9% | 58.3% | 26.1% | 34.1% |
| Sale when flock gets too large | 3.4% | 4.9% | 44.6% | 18.3% |
| Sale when cash is needed | 4.1% | 16.0% | 0.6% | 6.7% |
| Companion/happiness | 4.1% | 3.5% | 3.2% | 3.6% |
| Ceremony/religious | 0.7% | 0.7% | 0.0% | 0.4% |

## CHICKEN REARING AND PARENTAL RESTOCKING AFTER AI OUTBREAKS

The average numbers of Thai indigenous chickens in the surveyed households were 18.5, 37.0, and 42.3 in the Northeast, North and Central, respectively with more than 80 percent of the flocks being chicks and growers. Typically, Thai rural households have only 1-5 chickens (young or mature) per household. After the AI outbreaks, most parental restocking of indigenous chickens in the Northeast and the North was from the own area, while restocking in the Central was mainly from various external sources. The most common type of the birds used for restocking was growers or adult birds (68 percent) while only 10-20 percent of the surveyed farmers like to restock with young age chickens. Restocking is generally done by purchasing or asking for birds from neighbours or relatives. The cost of Thai indigenous roosters can vary from 25 to 10 000 baht with the more expensive roosters being of the fighting type. The price is mainly determined by the aggressiveness of the rooster. The average cost for replacing parent stock was in the range of 60-300 baht per bird. The average time between culling due to HPAI and restocking was about 6 months (Table 8) and the main selection criteria for parent stock for restocking were aggressiveness and large body size for males, and mothering ability and egg production for the females (Table 9).

***Table 8 Flock size and methods of restocking for Thai indigenous chickens***

| Characteristic | Northeast (N=148) | North (N=144) | Central (N=157) | Overall (N=449) |
|---|---|---|---|---|
| **Chickens / household** | 18.5 | 37.0 | 42.3 | 33.2 |
| - Rooster | 1.3 | 1.7 | 2.3 | 1.7 |
| - Hens | 3.1 | 5.3 | 4.6 | 4.4 |
| - Chicks & growing | 14.1 | 30.1 | 35.4 | 27.0 |
| **Source if parent stock is purchased** | | | | |
| - Local | 63.0% | 57.6% | 38.9% | 53.1% |
| - Various external sources | 28.6% | 23.5% | 60.5% | 37.4% |
| - Unknown | 8.4% | 18.8% | 0.6% | 9.5% |
| **Category if parent stock is purchased** | | | | |
| - Chicks (less than 3 wks old) | 21.8% | 14.7% | 14.3% | 14.0% |
| - Growing | 52.1% | 35.3% | 21.0% | 34.0% |
| - Mature | 23.0% | 38.2% | 33.0% | 34.0% |
| - Other | 3.0% | 11.8% | 11.7% | 18.1% |
| **Way of getting parent stock** | | | | |
| - Purchase | 51.3% | 55.3% | 20.4% | 42.4% |
| - Asking neighbours/relatives | 44.9% | 27.6% | 32.7% | 41.2% |
| - Exchange | 1.3% | 4.1% | 0.6% | 2.1% |
| - Other | 2.5% | 12.9% | 46.3% | 14.4% |
| Purchase cost of roosters (baht) | 25 – 1 500 | 100 – 10 000 | 150 – 7 000 | 25 – 10 000 |
| Restocking time after culling (months) | 6.6 | 5.5 | - | 6.1 |

***Table 9 Main criteria for selecting parent stock***

| Criteria | Male | | Female | |
|---|---|---|---|---|
| | First criteria | Second criteria | First criteria | Second criteria |
| Aggressiveness | 62.0% | 15.8% | 16.7% | 8.8% |
| Large body size | 17.6% | 46.2% | 4.9% | 3.4% |
| Colour | 16.0% | 16.7% | 11.0% | 4.4% |
| Health/ Disease resistant | 1.2% | 3.2% | 0.4% | 0.5% |
| Mothering ability | - | - | 44.1% | 38.7% |
| Egg production | - | - | 18.6% | 42.6% |
| Other | 3.2% | 18.1% | 4.2% | 1.5% |

## CHANGE OF MANAGEMENT AFTER AI

Information about management changes for Thai indigenous chicken rearing after the AI outbreaks is shown in Table 10. Overall, about 45 percent of the interviewees reduced their number of chickens but few stopped rearing. Main reasons for a reduction were being terrified by the AI outbreaks and the government policy with rather strict conditions for restocking in some areas. About 40 percent of the respondents reported that they keep the same number of chickens, while approximately 15 percent increased the number of chickens that they are rearing. Main reasons for increasing the flock size were confidence in several measures for improved management, and the growing demand for indigenous chickens that are claimed to be healthy/organic products.

The results of the survey do not clearly show whether the animal health and prevention policy of the Government was successful. About 20 percent of the respondents adopted the policy and tried to modify the pen and stall management and about 30 percent accepted a disease prevention programme. There were several pen/stall management changes, such as creating a chicken rearing boundary by simple fencing, surrounding the pen or stall with a nylon net, etc. The disease prevention changes which were accepted at a higher rate included monthly or quarterly cleaning with detergent, yearly spraying with disinfection agents and a vaccination programme for regular chicken disease control.

The most noticeable change of behaviour for farmers after the AI outbreaks was the eagerness to report sick chickens. Most farmers were keen to inform the village leader, or discuss with neighbour how to use local medicinal plants for disease protection or health improvement. This study found that less than 10 percent of respondents have changed their feeding management. Not only could they not see how feeding is related to the spread of disease, but this is also not in line with the typical way of raising indigenous chicken with more than 90 percent of the respondents still using free range or backyard rearing. With respect to discarding dead chickens, about 95 percent of the respondents still use the usual method which is burying in the ground. Approximately 5 percent of the respondents reported improved ways of discarding dead chickens including burying faraway from their own houses and in few cases burning.

***Table 10 Management changes for Thai indigenous chicken after AI outbreak (Percentage of respondents)***

| **Behaviour** | Northeast (N=148) | North (N=144) | Central (N=157) | Overall (N=449) |
|---|---|---|---|---|
| Numbers of chicken | | | | |
| - No change | 30.6% | 47.0% | 25.8% | 40.1% |
| - Decrease | 51.4% | 33.7% | 32.7% | 45.6% |
| - Increase | 18.1% | 19.3% | 3.5% | 14.2% |
| Pen/stall management | | | | |
| - No change | 74.5% | 65.2% | 98.1% | 79.5% |
| - Improving | 25.5% | 34.8% | 1.9% | 20.5% |
| Feeding management | | | | |
| - No change | 92.3% | 84.0% | 96.7% | 91.2% |
| - Improving | 7.7% | 16.0% | 3.3% | 8.8% |
| Disease prevention | | | | |
| - No change | 69.2% | 59.2% | 62.0% | 65.6% |
| - Improving | 30.8% | 40.8% | 38.0% | 34.4% |
| Disposal of dead chickens | | | | |
| - No change | 90.1% | 94.2% | 95.1% | 94.9% |
| - Improving | 9.9% | 5.8% | 4.9% | 5.1% |

# CHICKEN DATA ANALYSIS

## DIVERSITY OF THAI INDIGENOUS STRAINS BEFORE AND AFTER THE AI OUTBREAKS

The Thai indigenous chicken guideline (Nilpueng, 1999; DLD, 2003) was used to study the diversity of Thai indigenous chickens in the surveyed locations and only those chicken types that are shown in questionnaire Q3 were included in this study. These guidelines are well-known and recently admitted as as standard perfection for native chicken in Thailand. This characterization is based on Thai cultural heritage since hundreds of years for identifying types of Thai indigenous chickens by hackle, saddle and tail. Thai indigenous chicken strains are classified by their feather colour, which include the categories black (pradu), yellow, red, white, green, grey, bronze, straw and stripe. The purpose of this study was to investigate the change of the rooster strain diversity from the times before and after the AI outbreaks. In Thailand, smallholders raise their chickens with closed relationship. With the help of the sample pictures it was therefore possible to ask the owners about the colour or types of their chicken that they had possessed before the AI outbreaks. There were two reasons why the study considered only rooster: 1) the colour classification is clearer for males compared to females, 2) males are basically related to genetic forces in nature, such as selection, migration, and genetic drift.

The Table 11 shows the proportion of rooster strains that the interviewees possessed before and after the AI outbreak. Both, before and after the AI outbreaks the most common indigenous rooster strains in all regions of Thailand are black and yellow types, while Red, Green, Stripe and Straw colours are fewer. The White strain is a rare Thai indigenous chicken type. The study shows, that the proportion of Black and Green types slightly decreased after AI outbreak while those of mixture colour (unclassified colour) considerably increased. Crossbreeding between various sources to find the best fighting type without considering colour, search for hybrid vigour, fancy chicken creation or natural mating are all possible reasons for that observation.

***Table 11 Diversity of Thai indigenous chicken rooster strains before and after the AI outbreaks***

| Strain | Before AI Outbreak * | | | | After AI Outbreak | | | |
|---|---|---|---|---|---|---|---|---|
| | Northeast (N=153) | North (N=360) | Central (N=155) | Overall (N=668) | Northeast (N=194) | North (N=327) | Central (N=126) | Overall (N=647) |
| Black (Pradu) | 34.6% | 41.7% | 27.7% | 36.8% | 24.7% | 32.4% | 28.6% | 29.4% |
| Yellow | 26.1% | 25.8% | 32.9% | 27.5% | 29.4% | 27.2% | 17.5% | 26.0% |
| Red | 19.0% | 8.3% | 2.6% | 9.4% | 10.3% | 11.9% | 1.6% | 9.4% |
| Grey | 3.9% | 2.5% | 12.3% | 5.1% | 3.6% | 8.0% | 12.7% | 7.6% |
| Stripe | 3.3% | 5.6% | 5.2% | 4.9% | 10.3% | 7.0% | 4.8% | 7.6% |
| Green | 2.0% | 9.4% | 3.2% | 6.3% | 6.7% | 2.8% | 2.4% | 3.9% |
| Straw | 0.0% | 6.1% | 0.0% | 3.3% | 0.0% | 6.4% | 0.0% | 3.2% |
| Bronze | 7.8% | 0.6% | 0.0% | 2.1% | 4.1% | 1.2% | 0.0% | 1.9% |
| White | 2.0% | 0.0% | 0.0% | 0.4% | 3.6% | 0.6% | 0.0% | 1.4% |
| Unclassified | 1.3% | 0.0% | 16.1% | 4.0% | 7.2% | 2.4% | 32.5% | 9.7% |

Note: * Data are based on remembrance.

## DIVERSITY OF BACK FEATHER COLOUR, SHANK COLOUR, AND COMB OF THAI INDIGENOUS CHICKEN

A total of 679 mature and 387 young roosters were photographed and carefully classified for back feather colour, shank colour, and comb types. Mature and young roosters were classified according to mating history and age. Figure 4 shows the varieties of Thai indigenous chickens found in this study. The Table 12 shows that Red is the most common feather colour of Thai indigenous chickens (>50%). Black, yellow and straw colours were commonly found in young roosters, while white colour was rarely found in both mature and young roosters. This study showed that the proportion of Black or Pradu strain started to decline, while the Green, Bronze, and White strains were remarkably reduced.

***Figure 4 Thai indigenous chicken varieties classified by feather colour (A = Black, B = Yellow, C = Red, D = White, E = Stripe, F = Green, G = Grey, H = Straw)***

A

B

C

D

E

F

G

H

***Table 12 Current diversity of back feather colour in Thai indigenous chickens***

| Back Feather Colour | Mature Roosters | | | | Young Roosters | | | |
|---|---|---|---|---|---|---|---|---|
| | Northeast (N=188) | North (N=218) | Central (N=273) | Overall (N=679) | Northeast (N=53) | North (N=135) | Central (N=199) | Overall (N=387) |
| Straw | 33.1% | 30.0% | 25.5% | 29.0% | 9.4% | 9.6% | 24.1% | 17.1% |
| Red | 21.6% | 24.1% | 36.3% | 28.5% | 11.3% | 31.9% | 33.2% | 29.7% |
| Yellow | 24.5% | 11.6% | 7.8% | 13.4% | 24.5% | 20.7% | 14.6% | 18.1% |
| Grey | 9.7% | 18.2% | 15.0% | 14.6% | 13.2% | 8.9% | 3.0% | 6.5% |
| Black | 2.6% | 4.9% | 3.2% | 3.6% | 15.1% | 17.8% | 15.6% | 16.3% |
| White | 2.5% | 1.0% | 2.0% | 1.8% | 1.9% | 0.7% | 0.5% | 0.8% |
| Stripe | 3.8% | 8.7% | 7.3% | 6.8% | 7.5% | 7.4% | 5.5% | 6.5% |
| Green | 0.9% | 1.5% | 2.9% | 1.9% | 17.0% | 3.0% | 3.5% | 5.2% |
| Bronze | 1.2% | 0.0% | 0.0% | 0.3% | 0% | 0% | 0% | 0% |

***Table 13 Current diversity of shank colour in Thai indigenous chickens***

| Shank colour | Mature Roosters | | | | Young Roosters | | | |
|---|---|---|---|---|---|---|---|---|
| | Northeast (N=184) | North (N=218) | Central (N=273) | Overall (N=675) | Northeast (N=52) | North (N=132) | Central (N=199) | Overall (N=383) |
| Yellow | 54.4% | 62.2% | 45.1% | 53.1% | 46.2% | 59.9% | 46.7% | 51.2% |
| Yellow/Black | 39.1% | 28.2% | 41.9% | 36.8% | 28.9% | 23.5% | 36.2% | 30.8% |
| Black | 5.8% | 7.0% | 5.6% | 6.1% | 23.1% | 14.4% | 10.1% | 13.3% |
| Grey | 0.8% | 0.7% | 5.5% | 2.7% | 0.0% | 1.5% | 6.0% | 3.7% |
| White | 0.0% | 0.0% | 0.1% | 0.0% | 1.9% | 0.0% | 0.5% | 0.5% |
| Other | 0.0% | 1.8% | 1.8% | 1.3% | 0.0% | 0.8% | 0.5% | 0.5% |

***Table 14 Current diversity of comb type in Thai indigenous chickens***

| Comb type | Mature Roosters | | | | Young Roosters | | | |
|---|---|---|---|---|---|---|---|---|
| | Northeast (N=184) | North (N=218) | Central (N=273) | Overall (N=675) | Northeast (N=45) | North (N=132) | Central (N=199) | Overall (N=376) |
| Pea | 61.2% | 44.7% | 75.6% | 60.9% | 73.3% | 69.7% | 85.9% | 78.7% |
| Rock | 30.2% | 44.6% | 16.8% | 30.2% | 13.3% | 22.0% | 7.0% | 13.0% |
| Serpent | 3.0% | 7.2% | 4.1% | 4.9% | 0.0% | 6.1% | 3.0% | 3.7% |
| Single | 4.0% | 1.8% | 2.6% | 2.7% | 8.9% | 2.3% | 2.5% | 3.2% |
| Hornbill | 1.2% | 0.5% | 0.9% | 0.8% | 2.2% | 0.0% | 1.5% | 1.1% |
| Butter cup | 0.0% | 1.1% | 0.0% | 0.4% | 0.0% | 0.0% | 0.0% | 0.0% |
| Other | 0.4% | 0.0% | 0.0% | 0.1% | 2.2% | 0.0% | 0.0% | 0.3% |

The diversity of shank colours found by this study in Thai indigenous chickens is shown in Figure 5 and by Table 13. Yellow shanks and those which are yellow with black spots (yellow/black) are the most commonly found shank colours of Thai indigenous chickens (>80 percent). Pure black shanks occur only in the pure Black or Pradu strain, and they were therefore only found in 6-13 percent of the roosters surveyed by this study. Pure white shanks occur only in the pure White strain and as this is rare, only less than 1 percent were found with white shanks.

***Figure 5 Shank colours in Thai indigenous chicken (A = yellow, B = yellow/black, C black, D = grey, E = white).***


A


B


C


D


E

***Figure 6 Comb types in Thai indigenous chicken (A = Pea, B = Rock, C = Serpent, D = Single, E = Hornbill, F = Butter cup).***


A


B


C


D


E


F

There were six major comb types identified in chickens surveyed for this study. The diversity of comb types is shown in Figure 6 and the proportion of different types found in this study by the Table 14. The most common type was the pea comb (61 percent in mature roosters, and 79 percent in young rooster). The rock comb which is not seen in any commercial chickens was the second most common comb type in Thai indigenous chickens.

## MATURE WEIGHT PREDICTION

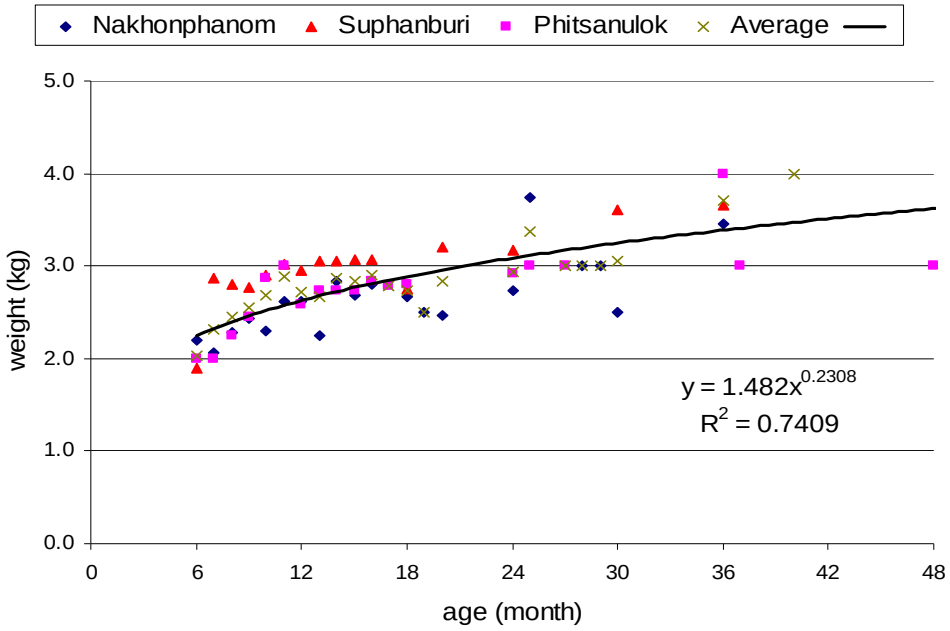
Table 15 shows the average mature weights of different types of Thai indigenous roosters in the three areas of the survey. The overall weight mature weight of Thai Indigenous chicken was 2.8 kg with the highest average from the Central region.

Prediction of mature weight of Thai indigenous chicken was tested with several mathematical equations, such as exponential, polynomial, logarithm. The best prediction equation was $MW = 1.482*AGE^{0.2308}$ ($R^2$ = 74.09%), where MW is the mature weight of the rooster and AGE is the age in month (see Figure 7). The Thai indigenous roosters in Suphan Buri (Central) were slightly heavier than the average trend line, while those in Nakhon Phanom (Northeast) were slightly lower than the average trend line. The Figure 7 indicates that the average mature weight of Thai indigenous chicken roosters is close to 3.5 kg at 36 month (3 years) of age, while the maximum weight at this age might be up to 4 kg.

***Table 15 Average mature weight of different types of Thai indigenous roosters***

| Chicken Type | Northeast (N=188) | North (N=218) | Central (N=273) | Overall (N=679) |
|---|---|---|---|---|
| Black | 2.7 | 2.6 | 3.0 | 2.8 |
| Bronze | 2.8 | - | - | 2.8 |
| Green | 2.8 | 2.5 | 3.0 | 2.8 |
| Grey | 2.7 | 2.7 | 3.0 | 2.8 |
| Mottle | 2.3 | 2.5 | 3.0 | 2.6 |
| Red | 2.5 | 2.7 | 3.0 | 2.8 |
| Straw | 2.6 | 2.6 | 2.9 | 2.7 |
| Stripe | 2.3 | 2.7 | 3.0 | 2.8 |
| White | 2.4 | 2.5 | 2.6 | 2.4 |
| Yellow | 2.6 | 2.8 | 3.1 | 2.8 |
| Black | - | 2.0 | - | 2.0 |
| **Average** | **2.6** | **2.7** | **3.0** | **2.8** |

***Figure 7 Mature weight prediction of Thai indigenous rooster***




## CONCLUSIONS AND RECOMMENDATIONS

The AI outbreaks resulted in several management changes of Thai indigenous chicken including improved housing and fencing of the rearing areas. However, the most noticeable change was the eagerness of farmers to report the occurrence of sick chickens. Most farmers are inclined to inform the village leader about poultry diseases and they use local medicinal plants for disease protection or health improvement.

The study identified an impact of the AI outbreaks on the genetic resources of Thai indigenous chickens. It appears that while the proportion of the Black or Pradu strain is declining, and the Green, Bronze, and White strains are already remarkably decreased the proportion of mixed colour types is increasing. This indicates a change of the population structure with an increased number of mixed strains. Genetic conservation measures may be indicated to secure the original strains of Thai indigenous chickens.

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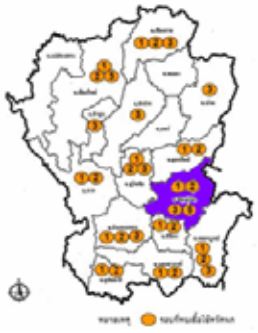
# APPENDIX I: SURVEY ACTIVITIES

| **Survey site strategy** | |
|---|---|
|  <br>Map of selected province (Phitsanulok) represented for the North part of Thailand; and selected District (Muang) of Phitsanulok province. | • Reviewing of the areas affected by Avian Influenza Outbreak in each part of Thailand, which is North, Northeast, and Central.<br>• Province with the best representative for AI Outbreak for each part was select.<br>• Left pictures show the province selection example for the North site. |
|  <br>Ban Mab Moo, Phitsanulok | • The selected Districts and villages were also discussed within the researcher team.<br>• The Number of household for questionnaires was followed by the TOR.<br>• One criterion for selection is all the villages must have been harmed from the AI outbreak. |
|  <br>The entrance road to Ban Wang Paya, Phitsanulok. The side canal is extensive used for agriculture. | • This project have stressed on the urban and agriculture area to reflect the actual life at farmer level. |

| | |
|---|---|
|  <br>Vegetable field in Nakhon Phanom | • Most of village survey has main agriculture in rice, vegetables, pepper, etc. |
|  <br>Native chicken raising under living house at Ban Lam Po, Phitsanulok, representing for a typical scene in the villages. | • Households with Native chicken or with leader has experiences in Native chicken were selected in this project. |
| **During the interview** | |
|  <br>The interview was carried out carefully and friendly for maximum corporation. | • Village leaders were interviewed by questionnaire Q1, while household leaders in each village were interviewed by questionnaire Q2 and Q3. |
|  <br>When some past information is needed, especially for AI Outbreak data in the past 5 years, most villagers were willing to gather around and providing information for this project. | • Villagers gathering around to provide the village information and helping each other to answer questionnaire Q1. |

| | |
|---|---|
|  <br>Weighing of Native chicken in Supanburi. | • Native chicken (young and mature roosters) were weigh and taken picture to investigate the genetic diversity. |
|  <br>The researcher team showed the pictures of Native chicken usually found around Thailand to the farmers to inspect the lost and restock genetic diversity. | • The impact of AI outbreak on the native chicken diversity has been interviewed with the pictures of Native chicken around Thailand, provided by this project. |
|  <br>The Burmese genetics among Thai native in Bang Sam, Supanburi. | • The mixture of exotic genetics and Thai native genetics was now occurred in some area. |

# APPENDIX II: VIEWS OF SURVEYED VILLAGES

| **Village information** | |
|---|---|
|  <br>The local feedstuff store and typical native chicken stall at Ban Ta Wua, Phitsanulok. | • General information for native chicken raising, feedstuff and veterinarian providers in village levels were inspected. |
|  <br>Ban Lam Po, Phitsanulok. | • Native chicken in Thailand can be found everywhere in the village.<br>• Native chicken along the street. |
|  <br>Nakhon Phanom | • Native chicken around temple in the village. |
|  <br>Ban Bang Sam, Supanburi. | • Native chicken in the rice field. |

| | |
|---|---|
|  <br>Typical native chicken housing for farmer. Net over the yard is for protecting the fly-over or migration bird contamination at Nakhon Phanom. | • Typical backyard housing for native chicken. |
|  <br>Nakhon Phanom | • The feed supplement for native chicken is performed in some farmers. The equipment shading from simple materials are constructed in the backyard. |
|  <br>Native rooster fighting, usually found among household. Ban Lam Po, Phitsanulok. | • Fighting behaviour in rooster, one of the characteristics for conserving native chicken. |

# APPENDIX III: QUESTIONNAIRES

## Q1. Village Information

**Village Leader Interview**

Village leader name ……..……phone……..……

Interviewer name ……Interview date……..……

Village name .....

Village No.....Tumbon.....Amphur ..... Province.....

GPS coordinates.…….……

**1. General data**

**1.1** *Number of household* **…**.....
**1.2** *Number of village member* **…**.....
**1.3 Number of household with native chicken** **…**.....
**1.4 Number of household with other chicken** **…**.....
**1.5** *Total village area* ..... *rai*
**1.6** *Village area (agriculture)* ..... *rai*
**1.7** *Main field crops***.....**
**1.8** *Main livestock***.....**
**1.9** *Number of local veterinarian/tecnician* .....
**1.10** *Number of Veterinarian product store* .....
**1.11** *Number of animal feed stuff store* .....

**2. Outbreak data**

| | 2007 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| Number of AI outbreak in the village | | | | | | |
| Number of household with destructive chicken | | | | | | |
| Number of destructive chicken in the village | | | | | | |
| Amount of compensation in baht | | | | | | |
| Number of spray prevention | | | | | | |

Government assistance before and after AI outbreak.

Do you agree or disagree with that policy? why?

# Q2. Houshold Information

*Interviewer name* **……***Interview date***…….**

Part A: General data

*Household data* **(Head / native chicken raising interview)**
*Respondent name* **…….……***Age***……**
**Household ID …….....**
*Household No ..... Village No..... Tumbon..... Amphur***..... ***Province*****.....**

**GPS coordinates:……..……..**
**1.2** *Experience in native chicken raising* **……** *year*
**1.3** *Reason to raise*
*1) Consumption* **[ ]** *Yes* **[ ]** *No*
*2) Sale when cash need* **[ ]** *Yes* **[ ]** *No*
*3) Flock sale* **[ ]** *Yes* **[ ]** *No*
*4) Companion/Life hapiness* **[ ]** *Yes* **[ ]** *No*
*5) Ceremony/religious* **[ ]** *Yes* **[ ]** *No*
*6) Fighting* **[ ]** *Yes* **[ ]** *No*
*7) Others* **……**
*Ranking by 4 the most importance.....*
**1.4 The raising native chicken was destroyed on month ……***year* **……..**
**1.5** *Type of destruction* **[ ]** *All* **[ ]** *Partial*
**1.6 Number of month for new raising after destruction ……...**
**Reason ……**
*Number of chicken in the date interview*
*Rooster ..... hd Hen.....hd Chicken/Growing* **…….** *hd Total .....hd*

## **Part B:** Parent stock data

*Source of parent stocks*
**[ ]** *Mostly from local source*
**[ ]** *Mostly from various sources (depend on convenient)*
**[ ]** *Other* **……..……**
**How to get the parent stocks (more than one answer allowed)**
**[ ]** *Purchase from* **[ ] Neighbour [ ] Market [ ] Other ……** *Cost .....Baht/Chicken*
**[ ]** *Trade with ..... from .....*
**[ ]** *Request from .....*

*Type of parent stocks from number 4*
**[ ] Chicken with less than 3 moth-old age**
**[ ]** *Growing/puberty chicken*
**[ ]** *Mature age chicken*
**Main criteria for selecting parent stock in 4**
*Rooster*
**[ ]** *No*
**[ ] Y***es (if yes, please rank the most 4 important reasons)*
**……** *Feather color Why?***…….**
**……** *Good fighting Why?***…….**
**……** *Large size Why?***…….**
**……** *Fast growing Why?***…….**
**……** *Good taste Why?***…….**
**……** *Easy feeding Why?***……**
**……** *Disease resistant Why?***……**
**……** *Other reasong Why?***……**

*Hen*
**[ ]** *No*
**[ ] Y***es (if yes, please rank the most 4 important reasons)*
**……** *Feather color Why?*……
**……** *Mothering ability Why?*……
**……** High *egg laying Why?*……
**……** *Good fighting Why?*……
**……** *Fast growing Why?*……
**……** *Good taste Why?*……
**……** *Easy feeding Why?*……
**……** *Disease resistant Why?*……
**……** *Other reasong Why?*……

**Part C: Before/After AI outbreak data**

Native rooster data
**7.1** *Numer of rooster BEFORE AI outbreak* **……***hd. Give details.*

| *Group (See given picture)* | *Number* | *Source* | *Reason* |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

**7.2** *Numer of rooster AFTER AI outbreak* **……***hd. Give details.*

| *Group (See given picture)* | *Number* | *Source* | *Reason* |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

Do you think feather colour or other type of native chicken before and after is different***? This situation is advantage or disadvantage? Why?***
……

***How do you change the management of Native chicken raising after AI outbreak?***
9.1 *Number of raising chicken* [ ] *Unchange* [ ] *Decrease* [ ] *Increase*
*Reason* ……
9.2 *Pen/Stall* [ ] *Unchange* [ ] *Improvement by* ..... *Reason* ……
9.3 *Feeding method* **[ ]** *Unchange* **[ ]** *Improvement by* .....
*Reason* ……
*9.4 Disease prevention* **[ ]** *Unchange* **[ ]** *Improvement by* .....
*Reason* ……
*9.5 Dead chicken discard method* **[ ]** *Unchange [ ] Throw away [ ] Put in the ground [ ] Burn*
*Reason* ……

# Q3. Chicken Diversity Information

***1. Househol data*** (Head / native chicken raising interview)
*1.1 Respondent name* **……***Age***……**
**Household ID ……..**
*Household No ..... Village No.....Tumbon.....Amphur*
**……***Province***……**
*Interviewer name* **……***Interview date***……..……**
*1.3 Total pictures* **……**

***2. Individual data for current mature (have been mated) rooster ..... hd***

| No. | *Group (See given picture)* | Age (m) | Weight (kg) | Comb type | Shank color | Picture ID | Remarks |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

***3. Individual data for current young rooster ..... hd***

| No. | *Group (See given picture)* | Age (m) | Weight (kg) | Comb type | Shank color | Picture ID | Remarks |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Note:
Comb type in native chicken: Single, Pea, Rose, Rock

Shank colour: Black, Yellow, Green, Yellow and black, etc.

## Native Chicken Pictures for Genetic Diversity Survey I

| GROUP | Type 1 | Type 2 |
|---|---|---|
| **BLACK (Pradu)** |  |  |
| **YELLOW** |  |  |
| **RED** |  |  |
| **WHITE** |  | |

## Native Chicken Pictures for Genetic Diversity Survey II

| GROUP | Type 1 | Type 2 |
|---|---|---|
| **STRIPE** |  |  |
| **GREEN** |  |  |
| **GREY** |  |  |
| **WHITE TAIL/ BRONZE** |  |  |