## APPENDICES

### Appendix 1. Questionnaire

1. Interviewer : Nguyen Thi Van Ha
2. Date : ____/____/_____
3. Name : _____
4. Address : No. _____ Moo:_____ Tambol: _____ Ampur: _____
5. **Egg Sample Code** : _____
6. Pesticide Use: No:____ Organochlorine : _____Amount : _____
   Organophosphates :_____
   Others : _____
   * Purpose: Malaria control:_____Agriculture: _____Kill pest : _____
   * Government Spray :_____Private Spray: _____inside house : _____
   outside house: _____

   * Frequency: _____ /year Period : _____
   * Area : _____ rai _____m2

7. Land Use Type:

8. Chicken :
   * Number of chickens: _____ Hens : _____ Chicks : _____
   * Hen Age : _____ years , Color :_____, Lay Egg Times :_____
   * Number of eggs : _____
   * Hens' Local Name : _____
   * Feeding ; Nature :_____ , Artifical feed: _____
   * Keeping : Enclosed : _____ , Free-range : _____

9. Special notes: _____
_____
_____
_____

## Appendix 2. Statistical Analysis Results

### 2.1 Comparison of Thai and German results of organochlorine analyses

Variable DIELDRIN

By Variable COUNTRY

Analysis of Variance

| Source | D.F. | Sum of Squares | Mean Squares | F Ratio | F Prob. |
|---|---|---|---|---|---|
| Between Groups | 1 | .0001 | .0001 | .1035 | .7501 |
| Within Groups | 28 | .0198 | .0007 | | |
| Total | 29 | .0199 | | | |

Levene Test for Homogeneity of Variances

| Statistic | df1 | df2 | 2-tail Sig. |
|---|---|---|---|
| .0024 | 1 | 28 | .961 |

Variable TOT DDT

By Variable COUNTRY

Analysis of Variance

| Source | D.F. | Sum of Squares | Mean Squares | F Ratio | F Prob. |
|---|---|---|---|---|---|
| Between Groups | 1 | .0109 | .0109 | .0005 | .9832 |
| Within Groups | 28 | 676.1723 | 24.1490 | | |
| Total | 29 | 676.1833 | | | |

Levene Test for Homogeneity of Variances

| Statistic | df1 | df2 | 2-tail Sig. |
|---|---|---|---|
| .0040 | 1 | 28 | .950 |

### 2.2 Comparison of organochlorine residues in eggs from different hens at the same house

+ group 1: 1-year old hen
+ group 2: 2-year old hen
+ group 3: 3-year old hen

Variable TOTAL DDT

By Variable HENS

Analysis of Variance

| Source | D.F. | Sum of Squares | Mean Squares | F Ratio | F Prob. |
|---|---|---|---|---|---|
| Between Groups | 2 | .0066 | .0033 | 6.8563 | .0103 |
| Within Groups | 12 | .0058 | .0005 | | |
| Total | 14 | .0123 | | | |

Levene Test for Homogeneity of Variances

| Statistic | df1 | df2 | 2-tail Sig. |
|---|---|---|---|
| 1.4664 | 2 | 12 | .269 |

(*) Indicates significant differences which are shown in the lower triangle

| Grp | 2 | 1 | 3 |
|---|---|---|---|
| Mean USE | | | |
| .0373 Grp 2 | | | |
| .0472 Grp 1 | | | |
| .1055 Grp 3 | * | * | |

Variable DIELDRIN

By Variable HENS

Analysis of Variance

| Source | D.F. | Sum of Squares | Mean Squares | F Ratio | F Prob. |
|---|---|---|---|---|---|
| Between Groups | 2 | .0017 | .0008 | 18.6731 | .0002 |
| Within Groups | 12 | .0005 | .0000 | | |
| Total | 14 | .0022 | | | |

Levene Test for Homogeneity of Variances

| Statistic | df1 | df2 | 2-tail Sig. |
|---|---|---|---|
| 4.8299 | 2 | 12 | .029 |

(*) Indicates significant differences which are shown in the lower triangle

| Grp | 2 | 1 | 3 |
|---|---|---|---|
| Mean USE | | | |
| .0173 Grp 2 | | | |
| .0402 Grp 1 | * | | |
| .0515 Grp 3 | * | | |

Variable CIS-HEPTACHLOR EPOXIDE

By Variable HENS

Analysis of Variance

| Source | D.F. | Sum of Squares | Mean Squares | F Ratio | F Prob. |
|---|---|---|---|---|---|
| Between Groups | 2 | .0001 | .0000 | 16.8495 | .0003 |
| Within Groups | 12 | .0000 | .0000 | | |
| Total | 14 | .0001 | | | |

Levene Test for Homogeneity of Variances

| Statistic | df1 | df2 | 2-tail Sig. |
|---|---|---|---|
| 1.6156 | 2 | 12 | .239 |

| | Grp | 2 | 1 | 3 |
|---|---|---|---|---|
| Mean | USE | | | |
| .0043 | Grp 2 | | | |
| .0093 | Grp 1 | * | | |
| .0130 | Grp 3 | * | * | |

## 2.3 Comparison of the means of Total DDT and p,p'-DDT p,p'-DDE ratios among the study areas

- - - - - Mann-Whitney U - Wilcoxon Rank Sum W Test

TOTAL DDT

by AREA

| | | Exact | | Corrected for ties | |
|---|---|---|---|---|---|
| | U | W | 2-Tailed P | Z | 2-Tailed P |
| San Kampaeng-Mae Rim | 2.0 | 47.0 | .0000 | -4.1862 | .0000 |
| San Kampaeng-Hang Dong | 8.5 | 53.5 | .0000 | -3.7883 | .0002 |
| San Kampaeng-Muang | 34.0 | 79.0 | .0476 | -2.0010 | .0454 |
| Mae Rim-Hang Dong | 171.5 | 361.5 | .4525 | -.7584 | .4482 |
| Mae Rim-Muang | 19.0 | 139.0 | .0000 | -4.4444 | .0000 |
| Hang Dong-Muang | 41.0 | 161.0 | .0002 | -3.5221 | .0004 |

DDT/DDE

by AREA

| | Exact | | Corrected for ties | |
|---|---|---|---|---|
| | U | W | 2-Tailed P | Z | 2-Tailed P |
| Mae Rim-San Kampaeng | 31.0 | 76.0 | .0030 | -2.8763 | .0040 |

+++ There is no significant difference of the ratio p,p'-DDT to p,p'-DDE among other study areas

## 2.4 Comparison of ratios p,p'-DDT p,p'-DDE, total DDT, p,p'-DDT, p,p'-DDE between DDT-sprayed areas and formerly DDT-sprayed areas

Variable DDT/DDE

By Variable USE

Analysis of Variance

| Source | D.F. | Sum of Squares | Mean Squares | F Ratio | F Prob. |
|---|---|---|---|---|---|
| Between Groups | 1 | 6.0406 | 6.0406 | 7.4535 | .0084 |
| Within Groups | 58 | 47.0054 | .8104 | | |
| Total | 59 | 53.0460 | | | |

Levene Test for Homogeneity of Variances

| Statistic | df1 | df2 | 2-tail Sig. |
|---|---|---|---|
| 2.4277 | 1 | 58 | .125 |

Cases

22 USE = DDT SPRAY

42 USE = DDT UNSPRAY

| | Corrected for ties | | | |
|---|---|---|---|---|
| | U | W | Z | 2-Tailed P |
| P,P'-DDD | 75.0 | 1102.0 | -5.4812 | .0000 |
| P,P'-DDE | 42.0 | 1135.0 | -5.9378 | .0000 |
| P,P'-DDT | 34.0 | 1143.0 | -6.0513 | .0000 |
| TOTAL | 32.0 | 1145.0 | -6.0793 | .0000 |

## 2.5 Comparison of total DDT residue in eggs from various land-use types

- - - - - Mann-Whitney U - Wilcoxon Rank Sum W Test

| | Exact | | Corrected for ties | | |
|---|---|---|---|---|---|
| | U | W | 2-Tailed P | Z | 2-Tailed P |
| Residential areas-Forestry and border areas | .0 | 483.0 | .0000 | -5.1998 | .0000 |
| Residential areas-Agricultural areas | 41.5 | 855.5 | .0000 | -5.2383 | .0000 |
| Forestry and border areas-Agricultural areas | 105.0 | 210.0 | .0822 | -1.7537 | .0795 |

## 2.6 Correlation among some variables

| Variable | Mean | Std Dev | Minimum | Maximum | N | Label |
|---|---|---|---|---|---|---|
| HEPTACHLOR | .00 | .00 | .000 | .004 | 64 | |
| DIELDRIN | .01 | .01 | .000 | .092 | 64 | |
| DDT/DDE | 1.16 | .95 | .06 | 4.73 | 60 | |
| TOTALDDT | 1.60 | 3.19 | .004 | 18.724 | 64 | |
| EGG WEIGHT | 40.06 | 4.81 | 30.7420 | 50.6543 | 62 | |
| RECOVERY | 99.72 | 7.71 | 85.0000 | 117.000 | 79 | |
| FAT | 13.40 | 1.88 | 9.8 | 19.6 | 64 | |

-------- CORRELATION COEFFICIENTS--------

| | CISHEP (n=79) | DIELDRIN (n=79) | PPDDD (n=79) | PPDDE (n=79) | PPDDT (n=79) | TOTAL (n=79) | WEIGHT (n=76) |
|---|---|---|---|---|---|---|---|
| CISHEP | 1.0000 | | | | | | |
| DIELDRIN | .7029** | 1.0000 | | | | | |
| PPDDD | -.0778 | -.2497* | 1.0000 | | | | |
| PPDDE | -.1227 | -.2037 | .6862** | 1.0000 | | | |
| PPDDT | -.1170 | -.2402* | .8899** | .8556** | 1.0000 | | |
| TOTAL | -.1213 | -.2327* | .8336** | .9562** | .9692** | 1.0000 | |
| WEIGHT | -.1930 | -.0849 | -.1129 | -.2445* | -.2150 | -.2363* | 1.0000 |

* p< 0.05, ** P<0.01

## 2.7 Mutiple regression

Formerly DDT-sprayed areas : F = 184.29432 Signif F = .0000

---------- Variables in the Equation ----------

| Variable | B | SE B | Beta | T | Sig T |
|---|---|---|---|---|---|
| PPDDD | 5.622570 | .453976 | .790622 | 12.385 | .0000 |
| PPDDE | .296286 | .093796 | .201649 | 3.159 | .0026 |
| (Constant) | -.018059 | .013409 | -1.347 | .1837 | |

DDT -sprayed areas : F = 52.08861 Signif F = .0000

---------- Variables in the Equation ----------

| Variable | B | SE B | Beta | T | Sig T |
|---|---|---|---|---|---|
| PPDDD | 7.969266 | 1.528797 | .557917 | 5.213 | .0000 |
| PPDDE | .471482 | .103079 | .489548 | 4.574 | .0002 |
| (Constant) | .119957 | .291063 | | .412 | .6849 |

## 2.8 Comparison of organochlorine residues in eggs from free-range hens and from commercial hens in Chiang Mai market

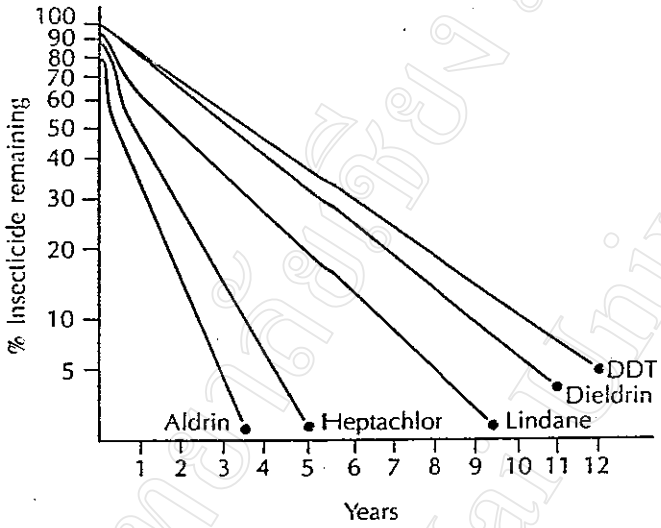
- - - - - Mann-Whitney U - Wilcoxon Rank Sum W Test

| Mean Rank | Cases | |
|---|---|---|
| 42.91 | 64 | EGG = NATIVE BREED EGG |
| 15.00 | 12 | EGG = COMMERCIAL EGG |

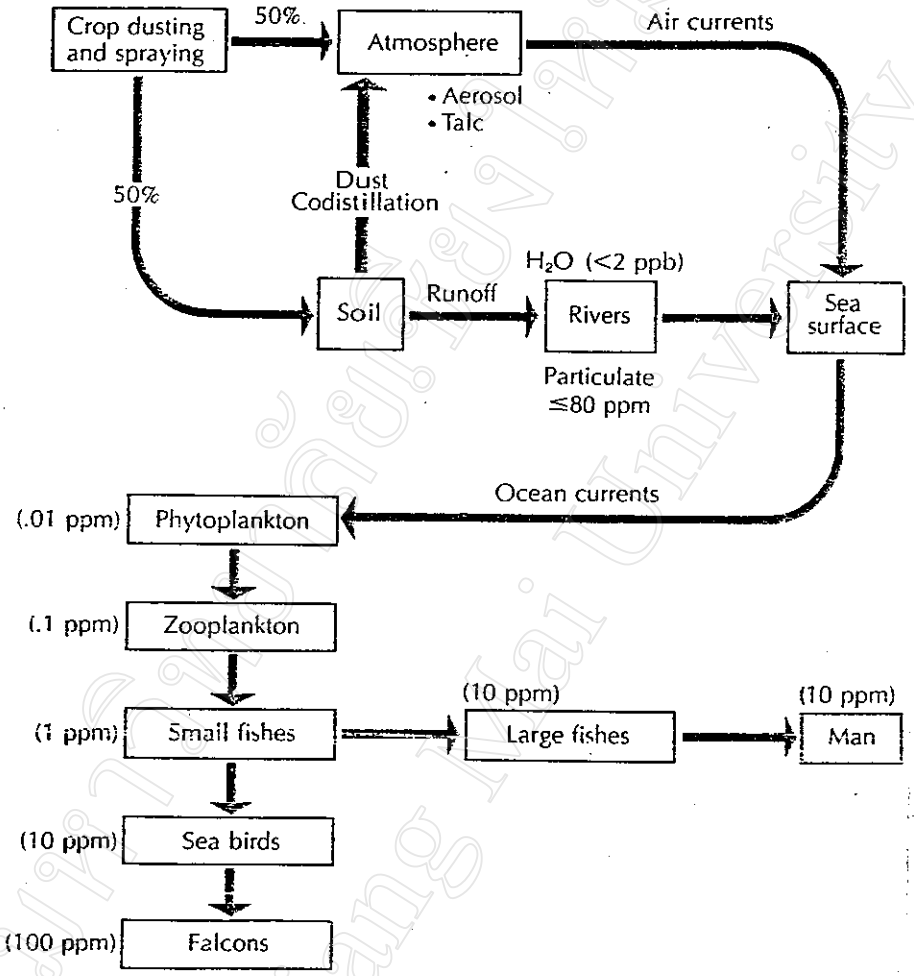
Corrected for ties

| | U | W | Z | 2-Tailed P |
|---|---|---|---|---|
| TOTAL DDT | 102.0 | 180.0 | -4.0178 | .0001 |
| DIELDRIN | 360.5 | 485.5 | -.3563 | .7216 |

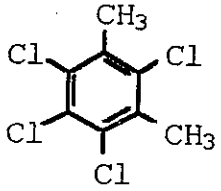
# APPENDIX FIGURES



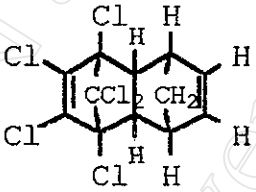

**Appendix Figure 1. Disappearance rates in soil of some organochlorine pesticides [5].**



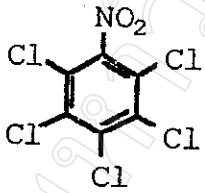

**Appendix Figure 2. One example of transport and biological magnification of DDT in the environment [5].**



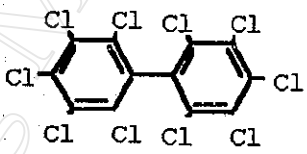

**Tetrachlor-m-xylene**




**Isodrin**

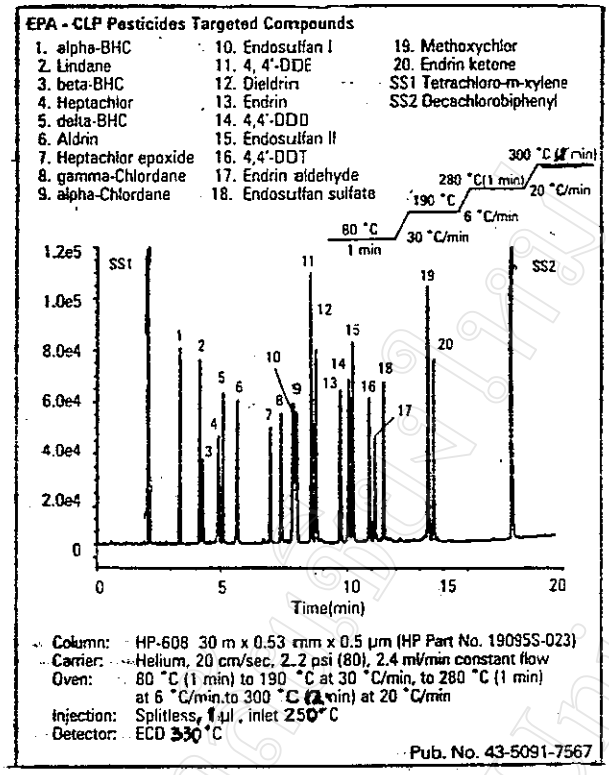


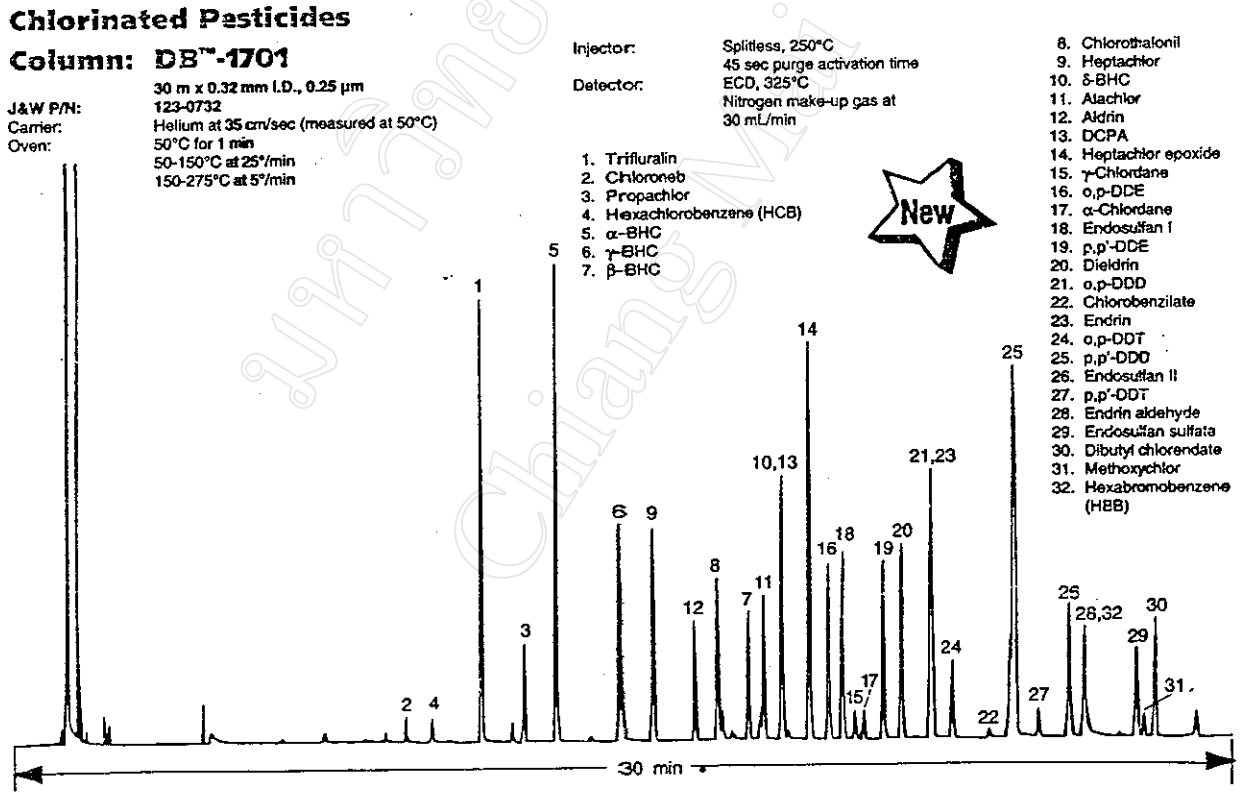

**Quitozene**




**PCB No.209**

**Appendix Figure 3. Structural fomulas of surrogates (ISTD) used in this study [9].**




**Appendix Figure 4. Chromatogram patterns of elution order of some organochlorine insecticides using different capillarly columns [63]**

# APPENDIX TABLES

## Appendix Table 1. Codex maximum residues limits and acceptable daily intake of organochlorines in chicken eggs

| Organochlorine compound | MRLs (mg/kg egg) | | (mg/kg fat) | ADIs (mg/kg body weight) |
|---|---|---|---|---|
| | WHO[a] | ThaiLand[b] | Germany[c] | WHO |
| Dieldrin | 0.1 | 0.1 | 0.2 | 0.0001 (1977) |
| Total DDT[d] | 0.5 | 1.5 | 1.0 | 0.02 (1984) |
| Endrin | 0.2 | ND | 0.05 | 0.0002 (1970) |
| Endosulfan[e] | 0.2 | ND | 0.01 | 0.006 (1989) |
| Heptachlor[f] | 0.05 | ND | 0.2* | 0.001 (1991) |
| Lindane | 0.1 | 0.5 | 1.0 | 0.008 |
| Total BHC | ND | 0.5 | ND | |

ND : no data

* : based on egg weight (i.e. mg/kg egg)

[a] Source from WHO and FAO, 1993 [36]

[b] Thai MRL are notification of the Ministry of Public Health No. 71 issued under Food Act. B.E. 2522, published in the Royal Government Gazette (special issue Vol.169, part 168, dated November B.E. 2525) [61]

[c] Source from R HmV vom 0.1.09, 1994 in BGBl L, page 2299-2301 (supplied by Dr Krueger) [d] Total DDT is sum of p,p'-DDE, o,p'-DDT, p,p'-DDE, p,p'-DDD

[e] Endosulfan is sum of α-endosulfan, β-endosulfan and endosulfan sulphate

[f] Heptachlor is sum of heptachlor and cis-heptachlor epoxide

**Appendix Table 2. Detailed information of hens'eggs from one house (No. 76/1, group 14, Suthep sub-district, Muang District)**

| Information about hen | | | Sampling date in order of egg laying | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hen age | color | weight | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th |
| 1-year old | black | 2 kg | 22/7 | 24/7 | 26/7 | 27/7 | 29/7 | 30/7 | 31/7 | 1/8 | 2/8 | 3/8 |
| 2-year old | brown | 2.5kg | 3/8 | 4/8 | 5/8 | – | – | – | – | – | – | – |
| 3-year old | black | 3 kg | 7/8 | 8/8 | – | – | – | – | – | – | – | – |

**Appendix Table 3. Detailed information of hens' eggs collected from Mae Rim District**

| Sampling site | | | | Date | Code of sample | DDT use | | Hens' information | | No* of egg |
|---|---|---|---|---|---|---|---|---|---|---|
| Sub-district | Group | Village | No. | | | Still[a] | Stop[b] | age | color | |
| Sa Luong | 5 | Muong Kha | | 3/11 | MK 1 | + | | >1 | brown | 3 |
| | | | 18/1 | 3/11 | MK 2 | + | | >1 | white | 5 |
| | 8 | Huay Som Suk | 3 | 3/11 | HSS1 | + | | <1 | white | 1 |
| | | | 48 | 3/11 | HSS 2 | + | | >3 | brown | 3 |
| | | | | 3/11 | HSS 3 | + | | <1 | black | 2 |
| | 2 | Sa Luong Nua | 51 | 3/11 | SLNa 1 | + | | <1 | brown | 7 |
| | | | 147 | 3/11 | SLNa 2 | + | | >1 | black | 7 |
| | 3 | Sa Luong Nok | 179 | 3/11 | SLNk 1 | | + | >1 | white | 10 |
| | | | 91 | 3/11 | SLNk 2 | | + | >1 | black | ND |
| | 5 | Hua Fai | 31 | 3/11 | HP1 | | + | >1 | black | 2 |
| | | | 1 | 3/11 | HP2 | | + | >3 | brown | 9 |
| Mae Rem | 8 | Mae Rim Noi | 2/1 | 2/11 | MRN 1 | + | | >2 | black | 2 |
| | | | 9 | 2/11 | MRN 2 | + | | >2 | brown | 7 |
| | | Pa Kha | 15 | 2/11 | PPK 1 | + | | >2 | black | 4 |
| | | Pan E.Kha | 28 | 2/11 | PEK 1 | + | | >1 | black | 5 |
| | 4 | Pang Hai | 10 | 2/11 | PH 1 | + | | <1 | black | 9 |
| | | | 10 | 2/11 | PH1A | + | | <1 | black | 9 |
| | | | 10 | 2/11 | PH 1-1 | + | | <1 | black | 6 |
| Don Kaew | 3 | Don Kaew | 32 | 27/12 | DK1 | | + | <1 | black | 6 |
| | | | 39 | 27/12 | DK2 | | + | <1 | black | 4 |
| | 4 | Sa la | 169 | 27/12 | DK3 | | + | <1 | black | 8 |

[a] DDT sprayed continuously in 40 years, until 1995 or at least 1992; [b]: stop spraying DDT for at least 30 years (reported by Malaria Center Region 2)

* Total number of eggs in the net

ND: no data

**Appendix Table 4. Detailed information of hens' eggs collected from Hang Dong District**

| Sampling site | | | | Date | Code of sample | DDT use | | Hen's information | | No of egg |
|---|---|---|---|---|---|---|---|---|---|---|
| Sub-district | Group | Village | No. | | | Still | Stop | year | color | |
| Nong Khoai | 3 | Khong Khin | 115 | 1/11 | KK 1 | | + | >1 | brown | 4 |
| | | | 140 | 1/11 | KK 2 | | + | >1 | black | 10 |
| Ban Pong | 4 | Huay Som Poi | 101 | 1/11 | HSP1 | | + | <1 | white | 6 |
| | | | 101/1 | 1/11 | HSP2 | | + | >1 | white | 4 |
| | | Huay Sieo | 168 | 21/08 | HS 1 | + | | >1 | | 1 |
| | | | 191/2 | 21/08 | HS 2 | + | | <1 | white | 2 |
| | | | | 21/08 | HS 3 | + | | <1 | white | 2 |
| | 3 | Mae Ha | 36 | 1/11 | MH 3 | | + | >3 | black | 5 |
| | | | | 1/11 | MH 4 | | + | >8 | black | ND |
| | 5 | Mae Ha | 51 | 1/11 | MH 1 | + | | >3 | brown | 9 |
| | | | 93 | 1/11 | MH 2 | + | | <1 | black | 15 |
| | 5 | Hua Pag Pai | 99 | 21/08 | HPP 1 | + | | >1 | black | 6 |
| | | | 68 | 1/11 | HPP 3 | + | | >1 | black | 4 |
| | | | | 1/11 | HPP 4 | + | | >1 | black | 5 |
| | 2 | Ban Pong | 103 | 1/11 | BP 1 | | + | >1 | black | 4 |
| | | | 31 | 1/11 | BP 2 | | + | >1 | black | 5 |
| | | | 73 | 1/11 | BP 3 | | + | >2 | gray | 6 |
| Ban Van | 6 | Dong Pai | | 16/11 | DP 1 | | + | <1 | black | 5 |
| Mae Kha | 2 | Nam Thon | | 26/11 | NT 1 | | + | <1 | black | 2 |

ND: no data

**Appendix Table 5. Detailed information of chicken eggs collected from San Kampaeng District**

| Sampling site | | | | Date | Code of sample | DDT use | | Hens' information | | No of egg |
|---|---|---|---|---|---|---|---|---|---|---|
| Sub-district | Group | Village | No. | | | Still | Stop | year | color | |
| San Kam Paeng | 9 | San Kam Paeng | 28 | 31/10 | SKP 1 | | + | <1 | black | 3 |
| | | | 36 | 31/10 | SKP 2 | | + | >2 | black | 4 |
| | | | 70 | 31/10 | SKP 3 | | + | >2 | black | 4 |
| Ton Pao | 7 | Pu Kha | 67 | 11/11 | PK 1 | | + | >3 | black | 4 |
| | | | 73/1 | 11/11 | PK 2 | | + | >1 | black | ND |
| Sai Mun | 1 | Don Mung | 17/2 | 11/11 | DM 1 | | + | >1 | black | 4 |
| | | | 10 | 11/11 | DM 2 | | + | >1 | black | 4 |
| | | Sam Khon May | 57/1 | 11/11 | SKM 1 | | + | >1 | black | 5 |
| | | | 60/1 | 11/11 | SKM 2 | | + | >1 | brown | 4 |

ND : no data

**Appendix Table 6. Detailed information of chicken eggs collected from Muang District**

| Sampling site | | | | Date | Code of sample | DDT use | | Hens' information | | No of egg |
|---|---|---|---|---|---|---|---|---|---|---|
| Sub-district | Group | Village | No. | | | Still | Stop | year | color | |
| Chan Puag | 4 | Huoy Chang Khian hilltribe village | 24 | 7/11 | HCK 1 | | + | <1 | black | 6 |
| | | | 16/1 | 7/11 | HCK 2 | | + | <1 | black | 4 |
| | | | 48 | 7/11 | HCK 3 | | + | >1 | black | 6 |
| | 5 | | 19 | 26/11 | M 4 | | + | >1 | black | 5 |
| | | | 17/112 | 26/11 | M 5 | | + | >1 | black | 6 |
| Su Thep | 9 | Headquarter of Doi Suthep-Pui National Park | | 7/11 | HQ 1 | | + | <1 | black | 4 |
| | | | 41 | 7/11 | HQ 2 | | + | >3 | black | 1 |
| | | Doi Pui | | 15/7 | Pui | | + | | | |
| | | | 239/19 | 5/11 | M 9 | | + | >2 | black | 3 |
| | 14 | | 76/1 | 28/7 | M 1 | | + | <1 | black | 10 |
| | | | | 26/7 | M 2 | | + | <1 | black | ND |
| | | | 77/12 | 26/7 | M 3 | | + | <1 | black | ND |
| Pa Dad | 6 | Van Sin Kham | | 26/11 | M 6 | | + | >1 | white | ND |
| | | | 28 | 26/11 | M 7 | | + | >1 | black | 6 |
| | 7 | Pa Det | 15 | 26/11 | M 8 | | + | < 1 | black | 3 |

ND : no data

**Appendix 7. Production characteristics of chickens in Thailand**

| Item | Unit | Traditional | Commecial |
|---|---|---|---|
| Age at which hen fist begin laying | Days | 190-250 | 165- 180 |
| Hen/rooster ratio | -- | 7-18 | 12- 15 |
| Replacement age of hens | Year | 3.5 | 1.5- 2 |
| Eggs per hatch | Eggs | 8-16 | -- |
| Average hatches per year | - | 3-5 | - |
| Eggs per year | - | 24-80 | 250-300 |
| Survivability of chicks to 60 days of age (no diseases ) | % | 72-87 | 95 |
| Mortality of hens | % | 10-15 | 2 |
| Hatchability | % | 58-94 | 80-95 |
| Weight at six months | | | |
| Male | kg | 1.5-2.0 | |
| Female | kg | 1.1-1.4 | |
| Weight at marketing (56days ) | | | |
| Male | kg | | 1.5-2.0 |
| Female | kg | | 1.5-2.0 |
| Weight at1 year | | | |
| Male | kg | 2.4-3.3 | - |
| Female | kg | 1.5 -2.4 | - |
| Weight at maturity | | | |
| Male | kg | 3.2-4.3 | - |
| Female | kg | 2.1- 3.2 | - |

Source: Village Level from Chantalakhana, (1981) and Khon Kaen University, (1979), Commercial Layers from Animal Science Departmemt, Kasetsart University. Data are quoted in C . Chantalakhana, The Village Farmer and His Livestock ,a paper presented at the International Brahman Congress on "Beef in a Changing World "organized by the Australian Brahman Breeders Association, Rockhampton, Queensland , Australia, April 1983, p.6 [65].

According to Dr. Tangtaweewipat at Department of Animal Husbandry, Faculty of Agriculture, Chiang Mai University, most traditional chickens in Thailand are *Gallus domesticus.*

**Appendix Table 8. Annual amount of DDT 75 WP (kg) used in the study areas (reported by Malaria Control Center Region 2)**

| District | 1995 | | 1994 | | 1993 | | 1992 | |
|---|---|---|---|---|---|---|---|---|
| | Amount | Moo* | Amount | Moo | Amount | Moo | Amount | Moo |
| Mae Rim | | | | | | | | |
| Saluong | 109 | 5,7,8 | 36.5 | 8 | 84.54 | 8 | 15.5 | 1,2 |
| Mae Rem | 138 | 4,8 | 83.5 | 3,8 | 0 | | 17 | 4,8,9 |
| Pon Ven | 68 | 8 | 68 | 2,7,9 | 0 | | 58.5 | 1,4,6,7,8,9 |
| Hang Dong | | | | | | | | |
| Naem Pra | 35 | 8 | 29 | 8 | 0 | | 15.5 | 8 |
| Ban Pong | 55 | 4,6 | 60 | 5 | 0 | | 41.5 | 4,5,6 |

* Moo : group of villages in a sub-district

Note : Total amount of DDT used in Thailand in 1995: 339061.5 kgs

Total amount of DDT used in Thailand in 1994: 463592.5 kgs

**Appendix Table 9. Organochlorine residues in eggs (mg/kg) from one hen and from different hens at the same house in one sampling site**

| No. of egg | Sample Code | Egg weight (g) | Fat (%) | Recovery (%) | Organochlorine residues (mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | is-hep-tachlor epoxide | o,p'-DDE | p,p'-DDE | Diel-drin | p,pDDD + o,pDDT | p,p'-DDT | DDT-total |
| * **1-year old hen** | | | | | | | | | | | |
| 1 | MA1 | 31.362 | 13.3 | 109 | .008 | .008 | .026 | .032 | .000 | .018 | .052 |
| 2 | MA2 | 34.793 | 11.5 | 109 | .008 | .007 | .017 | .040 | .000 | .037 | .061 |
| 3 | MA3 | 36.364 | 13.6 | 92 | .007 | .004 | .012 | .030 | .000 | .009 | .025 |
| 4 | MA4 | 36.960 | 12.1 | 102 | .008 | .000 | .013 | .033 | .000 | .009 | .022 |
| 5 | MA5 | 38.371 | 12.4 | 105 | .009 | .004 | .015 | .037 | .000 | .018 | .037 |
| 6 | MA6 | 37.239 | 12.8 | 91 | .009 | .004 | .015 | .037 | .000 | .009 | .028 |
| 7 | MA7 | 36.782 | 12.6 | 108 | .010 | .004 | .014 | .044 | .000 | .012 | .030 |
| 8 | MA8 | 37.916 | 11.8 | 105 | .010 | .005 | .017 | .048 | .014 | .032 | .068 |
| 9 | MA9 | 37.647 | 15.3 | 108 | .010 | .005 | .016 | .050 | .009 | .020 | .050 |
| 10 | MA10 | 37.434 | 11.6 | 107 | .014 | .024 | .017 | .051 | .028 | .030 | .099 |
| * **2-year old hen** | | | | | | | | | | | |
| 1 | MB1 | 42.721 | 12.3 | 106 | .005 | .005 | .014 | .018 | .008 | .019 | .046 |
| 2 | MB2 | 43.427 | 10.5 | 109 | .004 | .002 | .014 | .019 | .010 | .021 | .047 |
| 3 | MB3 | 41.845 | 11.8 | 89 | .004 | .003 | .013 | .015 | .003 | .000 | .019 |
| * **3-year old hen** | | | | | | | | | | | |
| 1 | MC1 | 38.423 | 13.0 | 116 | .013 | .007 | .053 | .051 | .000 | .049 | .109 |
| 2 | MC2 | 38.494 | 12.8 | 110 | .013 | .006 | .041 | .052 | .000 | .055 | .102 |

**Appendix Table 10. Organonchlorine residues in eggs from free-range hens in San Kampaeng, Mae Rim, Hang Dong, Muang Districts**

| Area[a] | DDT use[b] | land use[c] | Sample Code | Whole egg weight (g) | Fat (%) | Reco -very (%) | Organochlorine residues (mg/kg fresh weight) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Cis-Hepta -chlor | o,p'-DDE | p,p'-DDE | Diel-drin | o,p-DDD | p,p'-DDD o,p'-DDT | pp'-DDT | Total DDT |
| 1 | 1 | R | DM1 | 36.6458 | 15.0 | 97 | .000 | .004 | .008 | .002 | .000 | .004 | .004 | .020 |
| 1 | 1 | R | DM2 | 35.6317 | 13.7 | 92 | .000 | .002 | .006 | .001 | .000 | .002 | .003 | .013 |
| 1 | 1 | R | PK1 | 40.4288 | 19.6 | 95 | .000 | .003 | .010 | .000 | .000 | .003 | .006 | .022 |
| 1 | 1 | R | PK2 | 40.3267 | 13.6 | 93 | .000 | .002 | .008 | .000 | .000 | .002 | .004 | .016 |
| 1 | 1 | R | SKM1 | 41.6618 | 11.4 | 100 | .000 | .003 | .017 | .003 | .000 | .000 | .015 | .035 |
| 1 | 1 | R | SKM2 | 39.4365 | 12.6 | 96 | .000 | .000 | .004 | .000 | .000 | .000 | .000 | .004 |
| 1 | 1 | R | SKP1 | 33.3383 | 13.7 | 92 | .000 | .002 | .005 | .040 | .000 | .001 | .004 | .012 |
| 1 | 1 | R | SKP2 | 44.7596 | 14.8 | 97 | .000 | .001 | .007 | .001 | .000 | .001 | .002 | .011 |
| 1 | 1 | R | SKP3 | 41.0100 | 12.9 | 88 | .000 | .000 | .018 | .003 | .000 | .004 | .012 | .034 |
| 2 | 1 | A | SLNk1 | 42.1946 | 16.8 | 102 | .002 | .002 | .428 | .000 | .003 | .157 | 1.353 | 1.943 |
| 2 | 1 | A | SLNk2 | ND | 12.3 | 91 | .004 | .002 | .068 | .000 | .000 | .009 | .053 | .132 |
| 2 | 1 | A | HP1 | 47.1776 | 17.6 | 103 | .001 | .002 | .517 | .019 | .002 | .199 | 1.152 | 1.872 |
| 2 | 1 | A | HP2 | 43.8900 | 14.0 | 93 | .001 | .003 | .474 | .000 | .000 | .083 | .282 | .842 |
| 2 | 1 | R | DK1 | 34.8977 | 11.4 | 107 | .000 | .007 | .018 | .000 | .009 | .000 | .022 | .056 |
| 2 | 1 | R | DK2 | 41.0022 | 10.3 | 104 | .000 | .004 | .033 | .002 | .004 | .000 | .000 | .041 |
| 2 | 1 | R | DK3 | ND | 12.9 | 110 | .000 | .007 | .019 | .000 | .004 | .000 | .000 | .030 |
| 2 | 2 | F | MRN1 | 44.1542 | 13.3 | 86 | .000 | .003 | .820 | .000 | .000 | .160 | 3.880 | 4.863 |
| 2 | 2 | F | MRN2 | 31.4071 | 12.0 | 100 | .000 | .000 | 10.625 | .000 | .005 | .318 | 7.776 | 18.724 |
| 2 | 2 | F | PEK1 | 40.5649 | 12.6 | 91 | .000 | .000 | .905 | .002 | .000 | .046 | 1.030 | 1.981 |
| 2 | 2 | F | PH1 | 35.0066 | 14.1 | 100 | .000 | .000 | .662 | .005 | .000 | .084 | 1.484 | 2.23 |
| 2 | 2 | F | PH1-1 | 33.7550 | 14.3 | 100 | .000 | .000 | .583 | .012 | .000 | .062 | 1.230 | 1.875 |
| 2 | 2 | F | PH1-1A | 35.2565 | 12.4 | 100 | .000 | .000 | .734 | .000 | .008 | .164 | 1.552 | 2.458 |
| 2 | 2 | F | MK1 | 33.9425 | 13.8 | 109 | .004 | .003 | 3.133 | .000 | .004 | .536 | 5.787 | 9.463 |
| 2 | 2 | F | MK2 | 43.2630 | 11.0 | 95 | .004 | .004 | 4.184 | .000 | .008 | .555 | 6.278 | 11.029 |
| 2 | 2 | F | HSS1 | 32.7017 | 14.3 | 95 | .002 | .001 | 1.595 | .000 | .000 | .167 | 1.676 | 3.439 |
| 2 | 2 | F | HSS2 | 37.1926 | 15.9 | 98 | .000 | .002 | .028 | .000 | .000 | .006 | .069 | .105 |
| 2 | 2 | F | HSS3 | 38.3329 | 12.0 | 99 | .000 | .002 | .550 | .002 | .000 | .246 | .722 | 1.520 |
| 2 | 2 | A | SLNa1 | 33.6464 | 9.8 | 98 | .000 | .001 | .217 | .000 | .000 | .011 | .147 | .376 |
| 2 | 2 | A | SLNa2 | 48.0173 | 11.9 | 93 | .000 | .001 | .082 | .000 | .000 | .004 | .048 | .135 |
| 2 | 2 | A | PPK1 | 45.6474 | 12.9 | 108 | .000 | .000 | .000 | .002 | .000 | .029 | .571 | 1.179 |

Limit of determination : 0.001 mg/kg

[a] 1: San Kampaeng District, 2: Mae Rim District

[b] 1: Formerly DDT-sprayed areas, 2: DDT-sprayed areas

[c] R: Residential areas, A: Agricultural areas, F: Forestry and border areas

**Appendix Table 10. (cont.)**

| Area[a] | DDT use[b] | land use[c] | Sample Code | Whole egg weight (g) | Fat (%) | Reco-very (%) | Organochlorine Residues (mg/kg fresh weight) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Cis-Hepta-chlor | o,p'-DDE | p,p'-DDE | Diel-drin | o,p'-DDD | p,p'-DDD o,p'-DDT | p,p'-DDT | Total DDT |
| 3 | 1 | R | MH3 | 41.2321 | 13.2 | 94 | .001 | .002 | .020 | .007 | .000 | .006 | .014 | .042 |
| 3 | 1 | R | MH4 | 39.5244 | 16.4 | 100 | .000 | .000 | .018 | .007 | .000 | .008 | .039 | .065 |
| 3 | 1 | A | HSP1 | 32.1818 | 12.8 | 90 | .001 | .002 | .367 | .000 | .000 | .024 | .329 | .722 |
| 3 | 1 | A | HSP2 | 38.6799 | 13.2 | 94 | .000 | .003 | .102 | .000 | .000 | .000 | .055 | .160 |
| 3 | 1 | R | KK1 | 42.8012 | 15.6 | 106 | .000 | .004 | .009 | .015 | .000 | .000 | .007 | .020 |
| 3 | 1 | R | KK2 | 38.8007 | 9.8 | 105 | .000 | .004 | .013 | .000 | .000 | .000 | .013 | .030 |
| 3 | 1 | R | NT1 | 44.7334 | 13.7 | 101 | .001 | .001 | .024 | .002 | .000 | .005 | .009 | .039 |
| 3 | 1 | R | DP1 | 50.6543 | 13.3 | 99 | .002 | .001 | .017 | .029 | .000 | .002 | .001 | .021 |
| 3 | 1 | A | BP1 | 43.8083 | 16.0 | 91 | .000 | .000 | .850 | .000 | .000 | .031 | .636 | 1.517 |
| 3 | 1 | A | BP2 | 36.9200 | 16.5 | 99 | .002 | .002 | .177 | .000 | .000 | .004 | .039 | .222 |
| 3 | 1 | A | BP3 | 42.2021 | 12.7 | 99 | .000 | .003 | .307 | .000 | .000 | .019 | .030 | .359 |
| 3 | 2 | F | HS1 | 35.1000 | 15.9 | 117 | .000 | .000 | 4.050 | .011 | .000 | .171 | 3.462 | 7.683 |
| 3 | 2 | F | HS2 | 30.7420 | 12.0 | 116 | .000 | .000 | 1.870 | .000 | .000 | .158 | 2.669 | 4.697 |
| 3 | 2 | F | HS3 | 34.1020 | 12.8 | 117 | .000 | .000 | 2.302 | .000 | .000 | .187 | 2.615 | 5.104 |
| 3 | 2 | F | HPP1 | 37.1080 | 14.9 | 107 | .000 | .000 | 1.313 | .000 | .009 | .305 | 5.101 | 6.728 |
| 3 | 2 | F | HPP3 | 46.7850 | 13.1 | 114 | .000 | .003 | 1.440 | .003 | .002 | .080 | 1.433 | 2.958 |
| 3 | 2 | F | HPP4 | 47.2201 | 13.4 | 97 | .002 | .002 | 1.329 | .000 | .000 | .209 | .547 | 2.087 |
| 3 | 2 | A | MH1 | 39.1638 | 16.9 | 90 | .000 | .003 | 1.990 | .004 | .000 | .024 | .558 | 2.575 |
| 3 | 2 | A | MH2 | 46.8640 | 12.4 | 90 | .000 | .002 | .639 | .006 | .000 | .085 | 1.434 | 2.160 |
| 4 | 1 | R | M9 | 38.4588 | 14.6 | 95 | .000 | .001 | .006 | .000 | .000 | .004 | .009 | .020 |
| 4 | 1 | R | M6 | 46.3656 | 13.5 | 102 | .000 | .001 | .022 | .000 | .000 | .003 | .008 | .034 |
| 4 | 1 | R | M4 | 34.8150 | 13.9 | 98 | .001 | .001 | .004 | .000 | .000 | .002 | .005 | .012 |
| 4 | 1 | R | M5 | 41.2304 | 13.2 | 90 | .000 | .001 | .011 | .017 | .000 | .003 | .005 | .020 |
| 4 | 1 | R | M7 | 36.3521 | 12.3 | 85 | .000 | .001 | .005 | .001 | .000 | .005 | .010 | .021 |
| 4 | 1 | R | M8 | 39.3195 | 11.2 | 92 | .000 | .002 | .003 | .001 | .000 | .004 | .008 | .017 |
| 4 | 1 | F | HCK3 | 47.1118 | 13.0 | 100 | .000 | .000 | .137 | .000 | .000 | .043 | .141 | .321 |
| 4 | 1 | F | HCK1 | 37.2875 | 13.3 | 103 | .000 | .002 | .245 | .026 | .000 | .012 | .035 | .294 |
| 4 | 1 | F | HCK2 | 40.4311 | 10.5 | 90 | .000 | .001 | .472 | .002 | .000 | .029 | .051 | .553 |
| 4 | 1 | F | HQ1 | 43.5317 | 13.8 | 102 | .001 | .003 | .010 | .092 | .000 | .002 | .007 | .022 |
| 4 | 1 | F | HQ2 | 42.9462 | 12.8 | 99 | .000 | .004 | .084 | .004 | .000 | .006 | .022 | .116 |
| 4 | 1 | F | PUI | 43.9617 | 11.4 | 98 | .000 | .003 | .008 | .000 | .000 | .006 | .020 | .037 |
| 4 | 1 | R | M1 | 38.3710 | 12.4 | 108 | .000 | .005 | .015 | .038 | .003 | .008 | .019 | .050 |
| 4 | 1 | R | M2 | 48.0860 | 11.2 | 91 | .000 | .005 | .036 | .014 | .000 | .009 | .015 | .065 |
| 4 | 1 | R | M3 | 41.2530 | 13.1 | 99 | .000 | .001 | .010 | .002 | .000 | .002 | .000 | .013 |

Limit of determination : 0.001 mg/kg

[a] 3 : Hang Dong District, 4: Muang District

[b] 1 : Formerly DDT-sprayed areas, 2: DDT-sprayed areas

[c] R: Residential areas, A: Agricultural areas, F: Forestry and border areas

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