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Working Paper No. 11

Livestock and Livestock Health in Northern Thailand: A Socio-Economic Analysis of a Cross-sectional Survey of Villages

by

T. Murphy and Clem Tisdell

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T. Murphy and Clem Tisdell[2]

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[1] We are grateful to Dr. Pornchai Chamnanpood and staff at Hang Chat Veterinary Centre, Lampang and Mr Angus Cameron for providing survey data and to Dr. Steve Harrison for his input into the design of the survey. The usual *caveat* applies.

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The Commissioned Organization is the Queensland Department of Primary Industries. Collaborating institutions in Australia are CSIRO-ANHL, Geelong, Victoria and the University of Queensland (Department of Economics; Department of Geographical Sciences and Planning). In Thailand, the collaborating institutions are the Department of Livestock Development (National Institute of Animal Health; Disease Control Division), Chiang Mai University (Department of Agricultural Economics; Department of Animal Husbandry) and Thammasat University (Faculty of Economics). The collaborating institution in Laos is the Department of Livestock and Veterinary Services. Dr F.C. Baldock, Senior Principal Epidemiologist, Queensland Department of Primary Industries is the Project Leader in Australia and Dr P. Chamnanpood, Senior Epidemiologist, Thai Department of Livestock Development is the Project Leader in Thailand. Professor Clem Tisdell and Dr Steve Harrison, Department of Economics, University of Queensland are responsible mainly for the economic component of this project.

'The overall goal of this project is to develop and evaluate the .necessary tools to provide decision-makers with reliable animal health information which is placed in context and analysed appropriately in both Thailand and Australia. This goal will be achieved by improving laboratory diagnostic procedures; undertaking research to obtain cost-effective population referenced data; integrating data sets using modern information management technology, namely a Geographical Information System (GIS); and providing a framework for the economic evaluation of the impact of animal diseases and their control.

A number of important diseases will be targeted in the project to test the systems being developed. In Thailand, the focus will be on smallholder livestock systems. In Australia, research will be directed at the northern beef industry as animal health information for this sector of livestock production is presently scarce.'

For more information on *Research Papers and Reports Animal Health Economics* write to Professor Clem Tisdell (c.tisdell@economics.uq.edu.au) or Dr Steve Harrison,(s.harrison@uq.edu.au) Department of Economics, University of Queensland, Brisbane, Australia, 4072.

Livestock and Livestock Health in Northern Thailand: A Socio-Economic Analysis of a Cross-Sectional Survey of Villages

ABSTRACT

The development and growth of the Thai livestock industry in recent years has been significantly hindered by the level of endemic livestock disease in the South East Asian region. In rapidly developing countries such as Thailand, livestock diseases represent significant costs at the private and national level. Infectious livestock diseases such as Foot and Mouth, Aujeszky and Newcastle diseases reduce production and hence the income of livestock owners and create barriers to export of livestock products. Consequently animal health is becoming increasingly important in national development programs undertaken in Thailand and other South East Asian countries. There is a growing need for more rigorous economic and epidemiological analysis of livestock disease and disease control to enable more informed decisions to be made in terms of national animal health management. National disease control programs require significant expenditure and effort and have considerable information needs for effective management. The collection and analysis of socio-economic and epidemiological data in rural Thailand plays an important role therefore in the development of efficient and effective disease control programs for livestock. In this report we analyse data supplied by Mr Angus Cameron on behalf of Hang Chat Veterinary Centre, Lampang, Northern Thailand. This data was collected in late 1994 by direct survey of villages in three provinces in Northern Thailand.

Keywords: livestock disease, Thailand, small-scale livestock production

JEL Codes: Q160

Livestock and Livestock Health In Northern Thailand: A Socio-Economic Analysis of a Cross-Sectional Survey of Villages

1. Introduction

The development and growth of the Thai livestock industry in recent years has been significantly hindered by the level of endemic livestock disease in the South East Asian region. In rapidly developing countries such as Thailand, livestock diseases represent significant costs at the private and national level. Infectious livestock diseases such as Foot and Mouth, Aujeszky and Newcastle diseases reduce production and hence the income of livestock owners and create barriers to export of livestock products. Consequently animal health is becoming increasingly important in national development programs undertaken in Thailand and other South East Asian countries. There is a growing need for more rigorous economic and epidemiological analysis of livestock disease and disease control to enable more informed decisions to be made in terms of national animal health management. National disease control programs require significant expenditure and effort and have considerable information needs for effective management. The collection and analysis of socio-economic and epidemiological data in rural Thailand plays an important role therefore in the development of efficient and effective disease control programs for livestock.

The significant socio-economic change that has occurred in the region over the last few years has seen a growing commercial demand for livestock products and a shift away from traditional roles of village livestock in terms of draught power, transport and fertiliser. Given the income responsive nature of such products the rising income and population levels in Thailand have caused an increased demand for meat, milk and eggs (Murphy and Tisdell 1995 a,b). The growing commercialisation of the pig and cattle industries and the success of the Thai poultry industry over the last couple of decades has seen disease control become a commercial imperative. Although the traditional roles of livestock are beginning to change, the importance of livestock to the small-scale Thai farmer is still substantial. While commercial realities mean that larger scale livestock producers invest heavily into disease control, this is not so for most villagers owning livestock.

Recent ACIAR projects have attempted to address these village problems. Thai and Australian participants in ACIAR Project No. 9204 "*Improved Methods in Diagnosis, Epidemiology, Economic and Information Management in Australia and Thailand*" aim to develop and evaluate procedures that provide decision-makers with reliable animal health information analysed in the context of situations in both Thailand and Australia. In Thailand, the focus is on smallholder livestock systems. In this report we analyse data supplied by Mr Angus Cameron on behalf of Hang Chat Veterinary Centre, Lampang, Northern Thailand. This data was collected in late 1994 by direct survey of villages in three provinces in Northern Thailand. Suggestions for the questionnaire used were made by Dr Steve Harrison and Professor Clem Tisdell of the University of Queensland but the final questionnaire was determined by veterinary staff in Lampang who also conducted the survey.

2. The Survey

In line with the goals of the project, a cross sectional village survey was conducted in late 1994 to obtain socio-economic and epidemiological information about small-scale livestock production in Thailand. The survey was conducted by staff of Hang Chat Veterinary Centre in November 1994 (see Appendix A for Questionnaire). Three provinces in northern Thailand were surveyed with 14 villages being drawn from Chang Mai province (46.7%), 13 from Lampang (43.3%) and 3 from Lamphun (3%). Part 1 of this survey, the Individual Livestock Owner Questionnaire, gathered data from 25 villages, 14 in Chiang Mai and 11 in Lampang, compromising a total of 135 households. The survey results indicated that the person responding to the questionnaire was generally the member of the household with primary responsibility .for looking after the animals (ACIAR 1994).

3. General Socio-Economic Characteristics

This section provides a brief overview and some graphical representation of the general socio-economic features of small scale Thai producers sampled in the livestock owner questionnaire, as outlined in ACIAR (1994). Some additional statistical analysis is also included.

3.1 Livestock owner characteristics

The survey results indicate that those having primary responsibility for caring for the animals were predominantly male. Males comprised approximately 90% of the 135 interviewees and were on average 47 years of age (SD 12). Each household had an average of 4.3 members (SD 1.6) with an average age of 33 years (SD 18.7). Females comprised approximately 45% of the household members (ACIAR 1994).

3.1.1 School attendance

Survey responses indicated that approximately 16% of family members attended school the average age of school attendees was 10.8 years (SD 4.9). There was no significant difference between the proportion of males (53.5%) and females (46.5%) attending school (ACIAR 1994).

3.1.2 Workforce

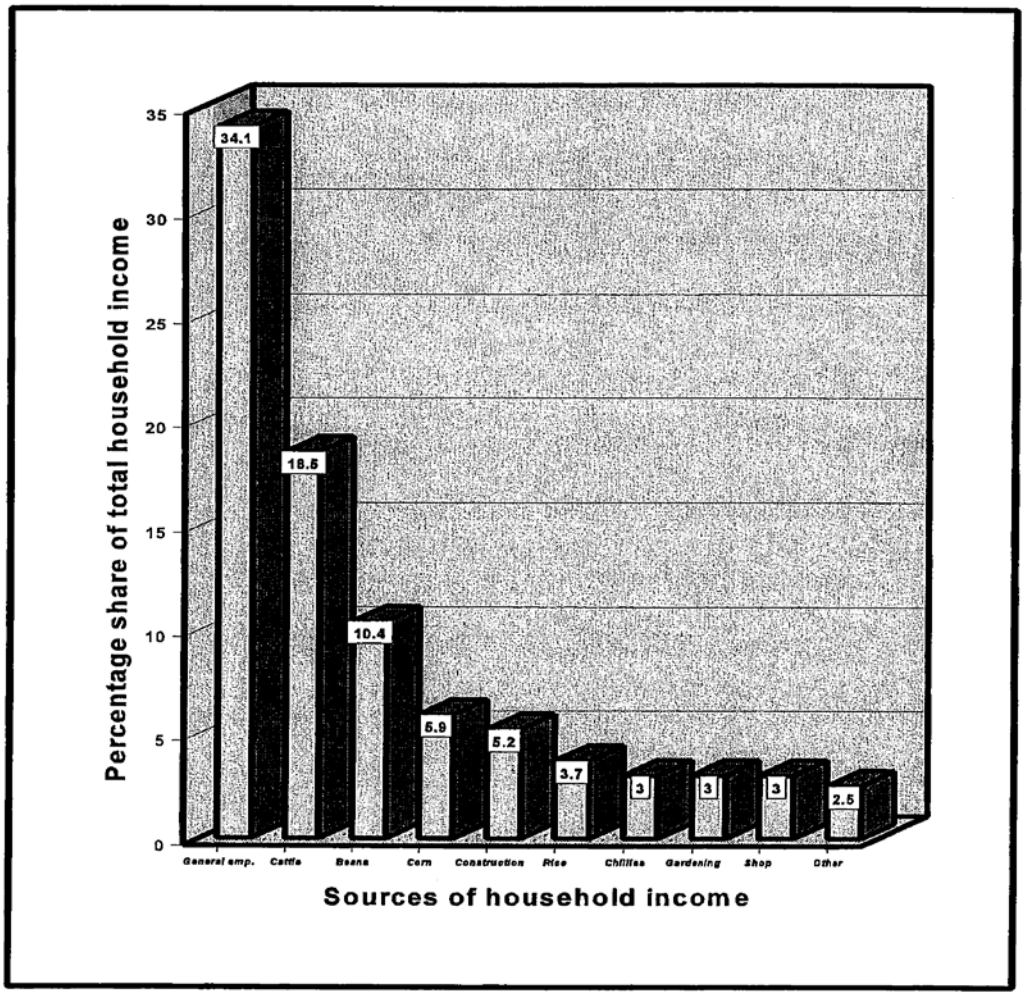
A greater proportion of family members were involved in working with crops (54%) than in stock work (44.2%). While men and women participated roughly equally in working with crops (55% to 45%), significantly[1] more males participated in stock work than females (ACIAR 1994). Of those family members involved in stock work and cropping, only around 0.5% attended school (ACIAR 1994).

A question was asked about the extent to which household members worked outside the village. Approximately 23% of family members, predominantly male (59%), worked outside the village for most of the year (on average 283 days) (ACIAR 1994). The type of work undertaken ranged from predominantly general employment (37%)[2] and construction work (29%). Other types of employment consisted of doll manufacturing (8.6%), longan harvesting (7.1%), being a government official (5.7%), weaving (2.9%) and forestry, selling clothes and retailing meat each 1.4% (ACIAR 1994). The general perception among family members interviewed, according to the survey results, was that this time spent by household members outside the village had not increased over the last 5 years.

3.1.3 Family income and income sources

The mean annual income per household was 33858 Baht[3] and ranged from 1000 to 360000 Baht with a median of 16000 Baht. The mean annual income per person (based on the number of family members) was 8961 Baht, ranging from 143 Baht to 120000 Baht (ACIAR

1994). From the survey it was found that the primary sources of income are general employment for 34% of households, followed by raising cattle (18.5%), growing beans (10.4%), growing com (5.9%), employment in the construction industry (5.2%), growing rice (3.7%), growing chillies, tending vegetable gardens and shopkeeping (3% each). The distribution of these sources of income can be seen in Figure 1. Raising cattle, general employment and rice farming accounted for around 63% of the secondary sources of income. When the first, second and third most important sources of income are combined, raising cattle and general employment account for 51.1% of the total income. The importance of animal products sold will be seen in the following section. However, it is possible that given the selection of villages by the Veterinary Centre for the purpose of collecting cattle serum, the sample of villagers has higher the normal proportion of cattle.



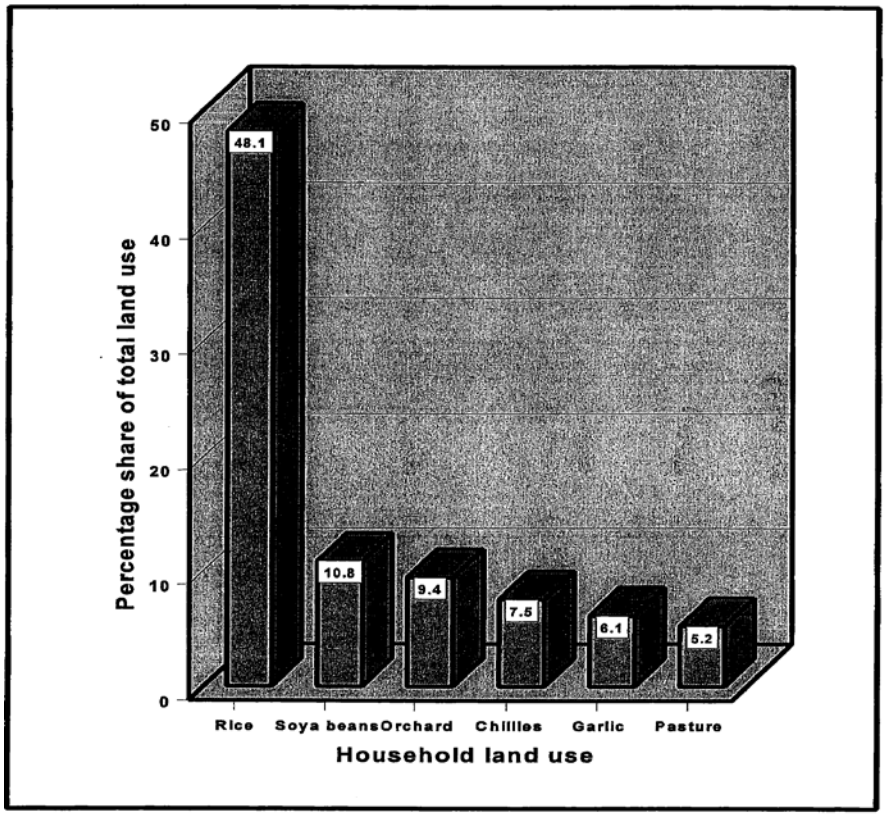
Source: Based on ACIAR (1994)

Figure 1 Primary income sources for Northern Thai village households (%) in sample

3.1.4 Land

A majority of the families surveyed owned land (80%). On average each family owned 9.16 Rai[4]. About 11% of Thai families rented land amounting on an average to 7.26 Rai per family. The remaining of households neither owned nor rented any land.

Of those owning and renting land, the highest proportion of householders stated rice farming as their primary land use (69.5%). This was followed by other crops such as chillies (7.6%), com (5.9%), soya beans and orchards (5.1% each), tobacco (2.5%), kitchen gardens (1.7%) and a teak plantation, sugar cane and pineapples (0.8% each) (ACIAR 1994). Major secondary land uses were rice farming and soya beans with orchards, garlic and again rice as an important tertiary land uses. As can be seen in Figure 2, with all land uses combined (primary, secondary and tertiary), the most important are rice fanning, soya beans, orchards, chillies, garlic and pasture (ACIAR 1994). The respective percentage share of each of these categories can be seen in Figure 2, with rice clearly the predominant use of land. Partly this poor relationship may be due to the importance of off-farm income.

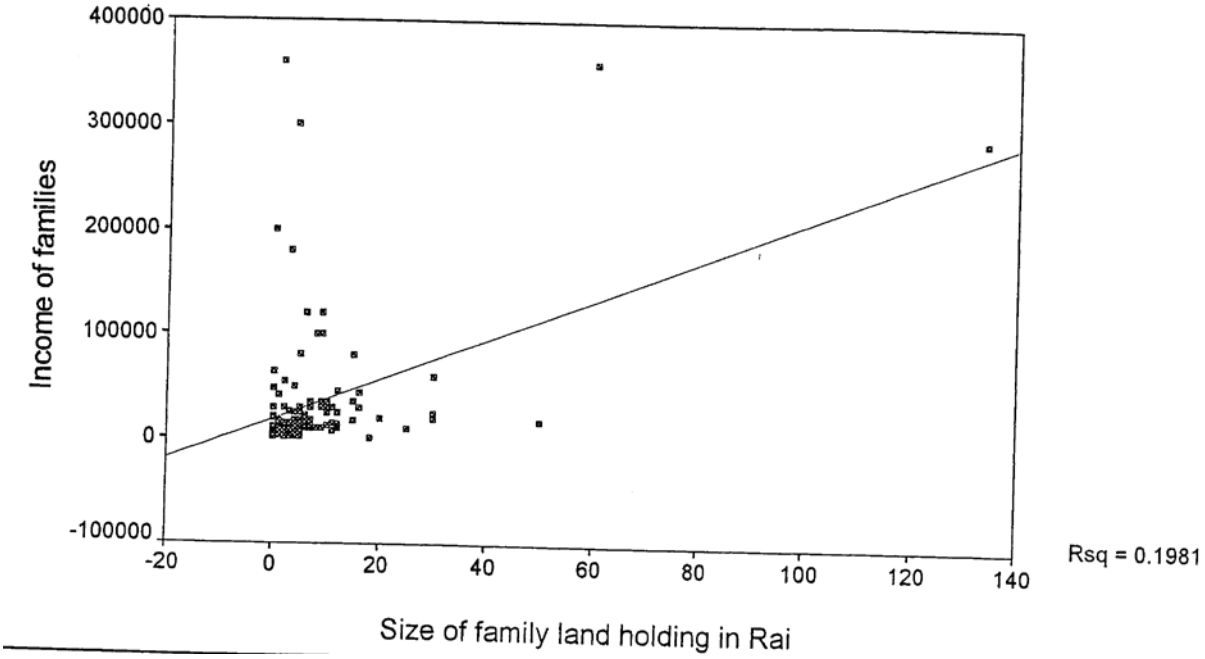


Source: Based on ACIAR (1994)

Figure 2: Land use of Northern Thai farms in sample

Figure 3 indicates a positive relationship between the extent of land ownership and income level in those households sampled. However while positive, the relationship between these two variables is not statistically close (R2=0.1981).

Figure 3: Family land and income level in North Thailand sample



3.1.5 Ploughing techniques

The growing mechanisation of Thai farming has been noted in Murphy and Tisdell (1995a,b). This process has helped explain the rapid decline in buffalo numbers over recent years in Thailand. The results of this survey indicate that buffaloes are now rarely used for ploughing. The survey found that fields were ploughed with a small tractor by 81.4% of households and with a large tractor by 15.3% of households surveyed (ACIAR 1994). Only two families (1.7%) used buffalo. A similar percentage stated that they used manual labour to harvest rice (ACIAR 1994).

3.2 Nature of livestock health assistance within villages

An important objective in the development of national disease control programs has been the provision of village assistance to improve animal health. The DLD has attempted in the past to provide technical health knowledge and education to farmers and village volunteers in order to strengthen national veterinary services (Khumnirdpetch, 1989). Therefore, in order to appropriately construct animal health programs at the village level, it is important to identify

the nature and type of health assistance sought by Thai villagers.

Several survey questions investigated the source and use of livestock health services and sources of information by livestock owners and the manner in which they treated their stock.

3.2.1 Who vil1agers asked for help

Question 26 of the survey asked the villagers who they asked for help with livestock diseases. The alternatives included:

1. Village key man (VKM)
2. District veterinary officer
3. Local village expert
4. Another officer in the village

Applying a Cross Tabulation (Table 1) to these categories reveals that: Across all income levels the village key man is the main person asked for help, representing 48.7% of the assistance sought. There is a negative association between the VKM's share of the health assistance and income level. In higher income groups, assistance from the village key men is less frequently sought. For example, 55% of families with an income level below 15,000 Baht consulted the village key man whereas only 36.4% of families with an income of 50,000 Baht and above consulted the VKM. Therefore in absolute terms a 20% fall in group share. The share of assistance sought from the District Veterinary Officer is higher among wealthier livestock owners and declines progressively as livestock owners become poorer.

Table 1: Who villagers asked for help vs. family income

Who villagers asked for help	**Income Category (Bht)**				
Count *Row Pct* *Col Pct*	0-15,000	15000-35,000	30,000-50,000	50,000 - 500000	*Row Total*
Non reported	16 51.6% 27.1%	11 35.5% 29.7%	2 6.5% 20.0%	2 6.5% 18.2%	31 26.5
Village Keyman	33 57.9% 55.9%	16 28.1% 43.2%	4 7.0% 40.0%	4 7.0% 36.4%	57 48.7%
District Vet.Off.	5 38.5% 8.5%	2 15.4% 5.4%	2 15.4% 20.0%	4 30.8% 36.4%	13 11.1%
Local Vill.Expert	5 33.3% 8.5%	7 46.7% 18.9%	2 13.3% 20.0%	1 6.7% 9.1%	15 12.8%
Another Officer	0 0% 0%	1 100% 2.7%	0 0% 0%	0 0% 0%	1 9%
Column Total	59 50.4%	37 31.6%	10 8.5%	11 9.4%	117 100%

Statistics – Chi Squared value (15.06) sig. .238

3.2.2 Sources of information

Question 27 endeavoured to determine who villages were able to consult for information on livestock disease. Sources of information include.

1. District veterinary officer
2. Public health officer
3. Local village expert

Applying a cross tabulation (Table 2) to these categories reveals that: of the lowest income group (less than 15,000 baht), the district veterinary officer (DVO) was strongly reported as the person consulted for information on livestock disease. This income group represented 90% of the total number who reported the DVO over all income groups as their source of information. Of the higher income groups, only the local village expert was consulted and represented 27% of this group's reports. High levels of non-reporting were observed in the two lower income groups represented over 80% of all non-reports. All groups however represented non-reports as a high proportion of their response.

Table 2: Source of information available vs. family income

Information source	**Income Category (Bht)**				
Count *Row Pct* *Col Pct*	0- 15,000	15000- 35,000	30,000- 50,000	50,000 - 500000	*Row Total*
Non reported	44 51.8% 78.6%	27 31.8% 93.1%	7 8.2% 100%	7 8.2% 63.6%	85 82.5
District Vet Off.	10 90.9% 17.9%	0 0% 0%	0 0% 0%	1 9.1% 9.1%	11 10.7%
Public Health Off.	1 50.0% 1.8%	1 50.0% 3.4%	0 0% 0%	0 0% 0%	2 1.9%
Local Vill.Expert	1 20.0% 1.8%	1 20.0% 3.4%	0 0% 0%	3 60.0% 27.3%	5 4.9%
Column Total	56 54.4%	29 28.2%	7 6.8%	11 10.7%	103 100%

Statistics – Chi Squared value (21.43) sig. .0108.

3.2.3 Statistics

Who villagers asked for help:

Pearsons Chi squared value (15.06, sig .23), representing the independence of the variables, indicates that there is not a significantly strong level of dependence between income groups and whom villagers consulted for assistance.

Sources of information:

Concerning the issue of who villagers asked for help, the Pearson Chi squared value (21.43, sig .01), representing the independence of variables, indicates there is not a strong dependence relationship between income groups and who villagers sought for assistance.

4. Cattle And Buffalo

On a national scale, Thailand's cattle and buffalo industries have experienced fluctuating fortunes in recent times. While the cattle industry has expanded in response to a growing demand for beef the numbers of buffalo has steadily declined with the increased mechanisation of Thai farming (Murphy and Tisdell1995 a,b). Furthermore, with the demand

for milk increasing, production of dairy cattle has become more prominent throughout Thailand (Murphy and Tisdell 1995b). The survey included questions designed to collect information on the number, health, treatment, maintenance, production and sale of bovines as well as the sale of and bovine products.

4.1 Cattle and buffalo numbers

Together the households surveyed owned a total of 51 buffalo, 17 of which were work animals. The total number of cattle owned was 1628 with 1553 of these being raised for meat (95.4%) (ACIAR 1994). Dairy cows made up only 2% of the cattle population. Consistent with broad national trends, 50.4% of livestock owners said that over the last five years their number of cattle had increased, often substantially. Cattle numbers had declined for only 20.6% of households. Of seven buffalo owners, two reported an increase in numbers and four reported a decrease in numbers (ACIAR 1994).

As can be seen from Figure Bl (Appendix B), there was no significant linear relationship between number of bovines owned and the income level of families (R2 = 0.0010). However, as is clear in Figure 4, there is a consistent decline in the mean number of bovines owned with higher family income.

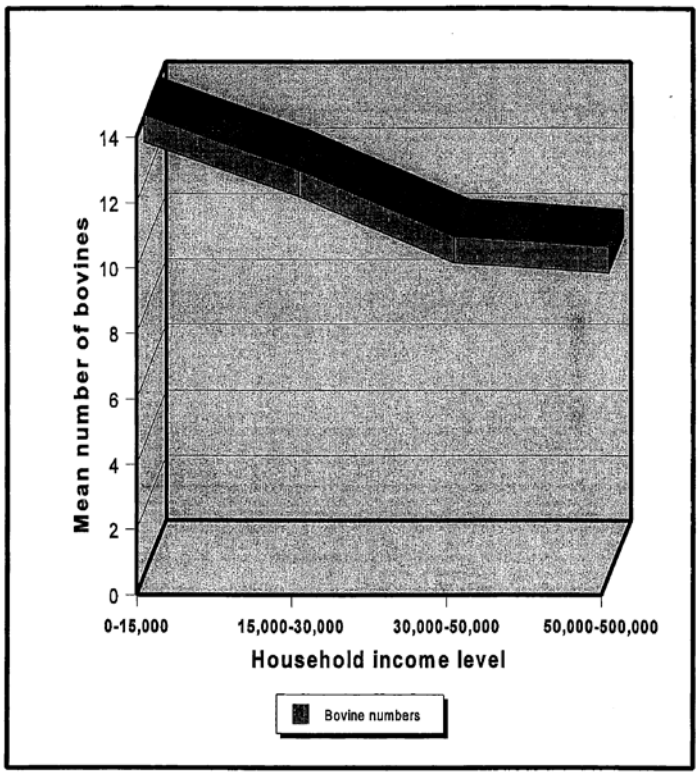


Figure 4: Number of bovines relative to household income levels

Table 3 indicates that virtually all households in the sample in Northern Thailand had bovines. The average number of bovines per household was 12.4 suggesting that this sample had an above average number of bovines per household in comparison to that for all the villages of Northern Thailand. The most frequent number of bovines for each household was two and the median was eight. The sample showed considerable variation in ownership of bovines as between households and a number of households had quite large herds by Thai standards. One, for example had a herd of 75 head.

Table 3: Distribution of bovines by households in survey in N. Thailand, 1994

No of Bovines	Frequency by	Percent	Valid Percent	Cum Percent
1.00	4	2.9	3.0	3.0
2.00	21	15.4	15.6	18.5
3.00	12	8.8	8.9	27.4
4.00	9	6.6	6.7	34.1
5.00	9	6.6	6.7	40.7
6.00	6	4.4	4.4	45.2
7.00	3	2.2	2.2	47.4
8.00	7	5.1	5.2	52.6
9.00	8	5.9	5.9	58.5
10.00	8	5.9	5.9	64.4
11.00	2	1.5	1.5	65.9
12.00	3	2.2	2.2	68.1
13.00	2	1.5	1.5	69.6
14.00	1	.7	.7	70.4
15.00	4	2.9	3.0	73.3
16.00	1	.7	.7	74.1
17.00	2	1.5	1.5	75.6
18.00	1	.7	.7	76.3
19.00	2	1.5	1.5	77.8
20.00	2	1.5	1.5	79.3
22.00	3	2.2	2.2	81.5
23.00	1	.7	.7	82.2
24.00	1	.7	.7	83.0
25.00	2	1.5	1.5	84.4
26.00	2	1.5	1.5	85.9
28.00	2	1.5	1.5	87.4
29.00	3	2.2	2.2	89.6
30.00	1	.7	.7	90.4
31.00	1	.7	.7	91.1
34.00	1	.7	.7	91.9
35.00	3	2.2	2.2	94.1
38.00	1	.7	.7	94.8
39.00	1	.7	.7	95.6
40.00	1	.7	.7	96.3
41.00	1	.7	.7	97.0
49.00	1	.7	.7	97.8
50.00	1	.7	.7	98.5
55.00	1	.7	.7	99.3
75.00	1	.7	.7	100.0
	1	.7	Missing	
Total	136	100.0	100.0	

Characteristics:					
Mean	12.422	Std err	1.116	Median	8.000
Mode	2.000	Std dev	12.963	Variance	168.052
Kurtosis	4.343	SE Kurt	.414	Skewness	1.899
S.E. Skew	.209	Range	74.000	Minimum	1.000
Maximum	75.000	Sum	1677.000		
Valid cases	135	Missing Cases	1		

4.2 Use and sale of bovine products

Bovines and bovine products were seen as the most important animal products sold by Thai villagers who participated in the survey. Live cattle were the most important animal product sold by 81% of the 121 households (ACIAR 1994). The survey results also indicated that cattle manure was the most important animal products sold by 10.7% of households (ACIAR 1994). When all animal products sold were grouped together, live cattle compromised 49% of household products sold, cattle manure 22.5%, cattle hides 15% with the remainder being made up of live pigs, chicken meat, live buffalo, buffalo manure, eggs and chicken manure (ACIAR 1994).

4.3 Location and nature of grazing of cattle and buffalo

Whether or not cattle from different herds have an opportunity to mix influences the spread of contagious diseases. In Thailand, the greatest opportunity for mixing of herds occurs during the wet season.

There are seasonal variations in the nature and location of grazing of stock by Thai villagers. The survey indicated that in the cool (dry) season, households mostly feed their cattle and buffalo in the empty rice fields. In the hot (dry) season, the empty rice fields are again the main source. In the wet season, however, little use is made of rice fields and livestock are mostly grazed in the forests and mountains (see Table 4 and Table 5).

Table 4: Private grazing

Season		At Home	Rice Field	Orchard Garden	Total
Cool	No*	22.	85.	5.	112
	%	16.3	63.	3.7	83
Hot	No*	19.	101.	3.	123
	%	14.1	74.8	2.2	91.1
Wet	No*	33.	11.	14.	58
	%	24.4	8.1	10.4	42.9

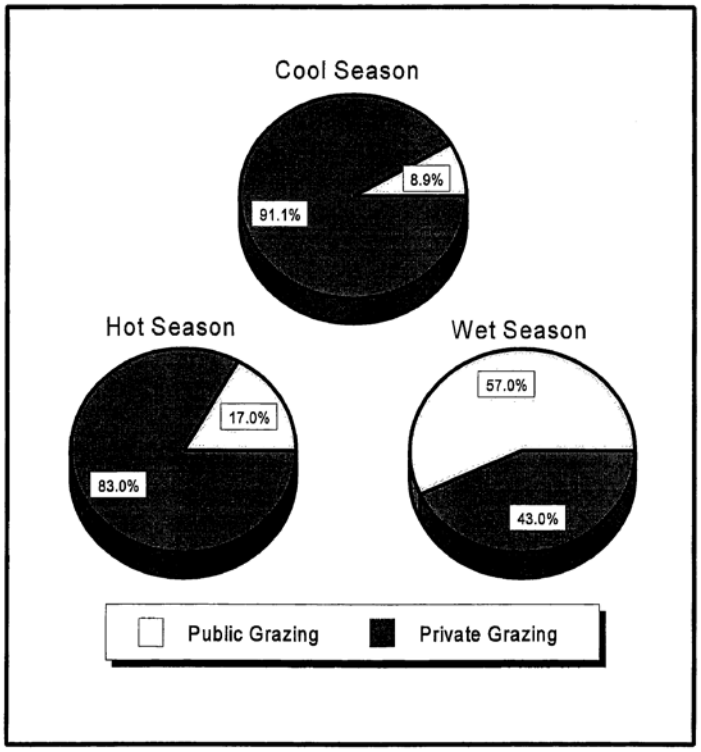
* Number of village families reporting

Table 5: Public grazing

Season		Public pasture	Forest	Mountain	Near water	Roads	Total
Cool	No*	2	12	6	0	3	23
	%	1.5	8.9	4.4	0.0	2.2	17
Hot	No*	0	7	1	4	0	12
	%	0.0	5.2	0.7	3.0	0.0	8.9
Wet	No*	5	56	13	0	3	77
	%	3.7	41.5	9.6	0.0	2.2	57

* Number of village families reporting

As Tables 4 and 5 indicate, the type of grazing can be broadly categorised as either public or private with the seasonal patterns represented graphically in Figure 5. It is clear that public (communal) grazing is particularly evident in the wet season. At those times Thai livestock owners mostly graze their stock in the forests and mountains.



Source: Based on ACIAR (1994)

Figure 5: Incidence by season of public (communal) grazing vs private grazing for bovines in village sample in Northern Thailand.

The nature of grazing is regarded as an important factor in the degree of infection and spread of FMD in village stock. As Donaldson (1994) noted, seasonal variations in animal husbandry can markedly influence the spread of FMD in a herd and its severity. Stocking density and increased contact through communal grazing are significant factors in the spread of FMD. For instance the seasonal patterns of FMD outbreaks in Africa have been explained by Rweyemamu (1970 in Donaldson 1994) as a consequence of climate and increased animal contact. In Africa during the wet season, animals are dispersed due to prevalence of water holes. Consequently, there is little opportunity for the dissemination of the FMD virus. By contrast, in the dry season, animals congregate at the limited number of waterholes and hence there is increased contact between livestock and of livestock with wildlife. Therefore, a greater opportunity exists for the spread of infection. While communal grazing and interaction of herds is most common in Africa during the dry season, in Thailand it is most common in the wet season. The latter is the case in Thailand because at that time rice fields are under cultivation and unavailable for grazing.

4.4 Problems and diseases of cattle and buffalo

The most important problems for cattle and buffalo were stated by the interviewees to be Foot and Mouth disease (39%) and leg injuries (14.3%). Other minor reported problems were fever, bloat weight loss and tetanus (ACIAR 1994).

4.4.1 Responsibility for treatment

The responses of villagers to disease problems in cattle and buffaloes were reported to be ‘buying medicine and treating the animals themselves’ (41%), ‘asking the district veterinary officer’ (24%), ‘asking the village keyman’ (20%), and ‘asking the local village expert’ and ‘giving no treatment’ (3%) (ACIAR 1994). Most villagers treated FMD with medicine purchased themselves. Only three people reported problems with buffalo diseases, two citing FMD and one tetanus. These diseases were treated by themselves or by district veterinary offices (ACIAR 1994).

4.4.2 Statistics

Sickness and mortality:

There is a declining trend in the mean proportion of bovine sickness and death as family income levels rise, as is evident in Figure 6. This figure graphs the progressive means of

morbidity and of mortality of bovines and household income.

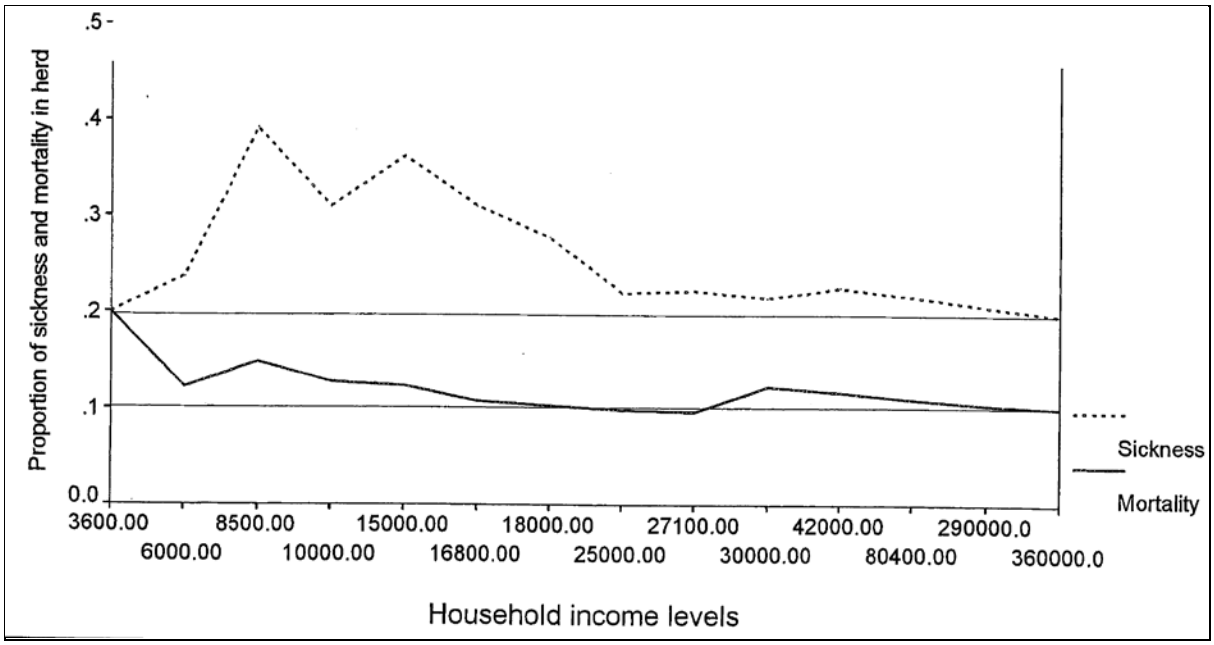


Figure 6: Mortality and sickness of bovines related to income levels in Thailand: progressive mean.

Treatment of Cattle:

Analysis of cattle treatment relative to family income level clearly indicates that a higher proportion of lower income families (those below 30,000 Baht) fail to treat their cattle than do higher income families (those above 30,000 Baht).

Response to FMD:

Analysis of how livestock owners responded to an outbreak of FMD indicated that the majority (62%), regardless of wealth (income level), took no action when an outbreak was reported. Of those households that failed to do anything about the outbreak, the below average income groups represented 78% of the reported cases.

4.5 Overall observations on bovines

In this sample of villagers in Northern Thailand, bovines (cattle and to a lesser extent buffalo) were the main source of income from livestock. The 135 households in the sample had an

average of 12.4 bovines per household. The frequency distribution is shown. It is possible that this sample consists of village households with a higher degree of ownership of bovines than the average in Northern Thailand given that the villages were selected by veterinary staff with a view to collecting serum samples from bovines for analysis.

Analysis of the results suggest that the incidence of mortality and particularly morbidity of bovines shows a tendency to decline as the income level of households owning them increases. This may be because animals of those on higher incomes obtain more health services and better nutrition. It is observed that in contrast to those on lower incomes, households with higher incomes make considerable use of the services of the district veterinary officer in treating their cattle and buffalo. This may be a consequence of socio-economic factors, e.g., education and income may be correlated, those on higher incomes may be more at ease in dealing with government officials. Scope may therefore exist for targeting government veterinary services more to poorer villagers with livestock.

5. Pigs

In recent years the number of small pig holdings in Thailand has decreased relative to larger ones involved in commercial production (Murphy and Tisdell 1995). However the increased demand for pork has seen the need for improved animal health at both the small and large-scale production levels. In the survey questions were asked about disease prevention incidence, treatment, sales and production of pigs by livestock owners.

5.1 Pig numbers

Only 11.9% of the 135 households surveyed kept pigs and on average they kept 4.25 pigs per household. While a majority of these households reported no overall change in pig numbers, they reported that two litters had been born with an average litter size of eight piglets, six pigs had died and six had been killed (ACIAR 1994).

5.1.1 Statistics

Pig ownership:

Statistically there is no clear relationship between the number of pigs owned and the financial position of the Thai villagers with pigs. Applied linear regression suggested a negligible

relationship between pig numbers across all groups and income level (R2 = 0.00. F = .00006).

5.2 Problems disease and disease prevention

According to the survey, the main problems households had with their pigs were diarrhoea, swine fever, the expense of food, coughing, low prices and high fever. Diarrhoea was the most important disease. It was reported by six households, while high fever was reported by one household. Of those livestock owners that treated their pigs for sickness, the majority (78%) applied their own treatment, at a cost of 10-20 baht (ACIAR 1994). The remaining households used the village keymen to treat their livestock (ACIAR 1994).

5.2.1 Statistics

Pig Mortality:

As can be noted, deaths of six pigs were reported by the Thai producers sampled. The relationship in terms of dependence between mortality and income level was negligible.

Pig Sickness:

The survey analysed the frequency of reported sickness both in piglets (under 2 months) and older pigs (over 2 months). Limited significance was reported for correlations between sickness of pigs and income levels (R2=.00061) (see Figure 2, Appendix B).

Pig Treatment:

Cross-tabulation of treatment vs income levels suggests there is limited dependence between income and nature of treatment of illness in pigs (Pearsons R - .03924), with self-treatment and advising village key men the only form of treatment undertaken.

5.3 Production

The survey provided information on the average litter size and sale of pigs and the place of the sale. Only one owner had a sow for breeding pigs. The remaining pig owners purchased piglets from within the village or outside the village privately (ACIAR 1994). Pigs were bought for an average of 445 baht and sold at mean age of 5.7 months for 65 baht per kg (ACIAR 1994).

5.3.1 Statistics

Pigs sold:

While livestock owners earning more than 30,000 Baht sold the two highest number of pigs, there was no significant relationship between the number of pigs sold and income level (Figure 3, Appendix B) (R2=0.00006). Chi-squared analysis further highlighted the independence of the two variables and their limited significance level (sig = .08037).

5.4 Overall observation on pigs

In the villages surveyed, the majority of householders surveyed did not keep pigs whereas about all households had cattle. Only one of the 135 households was involved in breeding pigs. Most purchased a small number of pigs from elsewhere and it seems that most pigs were fed on household scraps and farm wastes. Essentially the rearing of pigs was a 'backyard' operation with little investment occurring in maintaining the health of the animals.

6. Poultry

While the commercial poultry industry in Thailand has grown significantly, large numbers of village poultry still occur in Thailand. Several survey questions were concerned with the disease, disease prevention, production, selling and treatment of poultry by village owners of poultry.

6.1 Poultry numbers in Thailand

Most village households in Thailand keep poultry. As noted in Murphy and Tisdell (1995a,b), poultry is an important component in the integrated village farm system in Thailand. Poultry is generally used by village householders to provide either food (eggs and meat) or supplementary income. Of the households sampled 81.5% kept poultry - native chickens and ducks. The keeping of ducks was much less common than the keeping of fowls. Most (two-thirds) livestock owners claimed that no significant change in poultry numbers had occurred over the last five years. However a third of owners said numbers had decreased (ACIAR 1994).

6.1.1 Statistics

Number of Poultry:

The amount of poultry owned by livestock owners increased with income level. A progressive mean was applied in Figure 7 that indicates an increasing trend in the number of poultry as income levels rise (across four categories). Linear regression and Chi-squared analysis indicated however that a strong statistical relationship was not evident. Figure B 4 in Appendix B indicates the limited positive relationship (R2 = .0121). Cross-tabulation indicated a non-significant relationship between income and number of poultry owned (Chi-squared 71.78, sig = .48485)

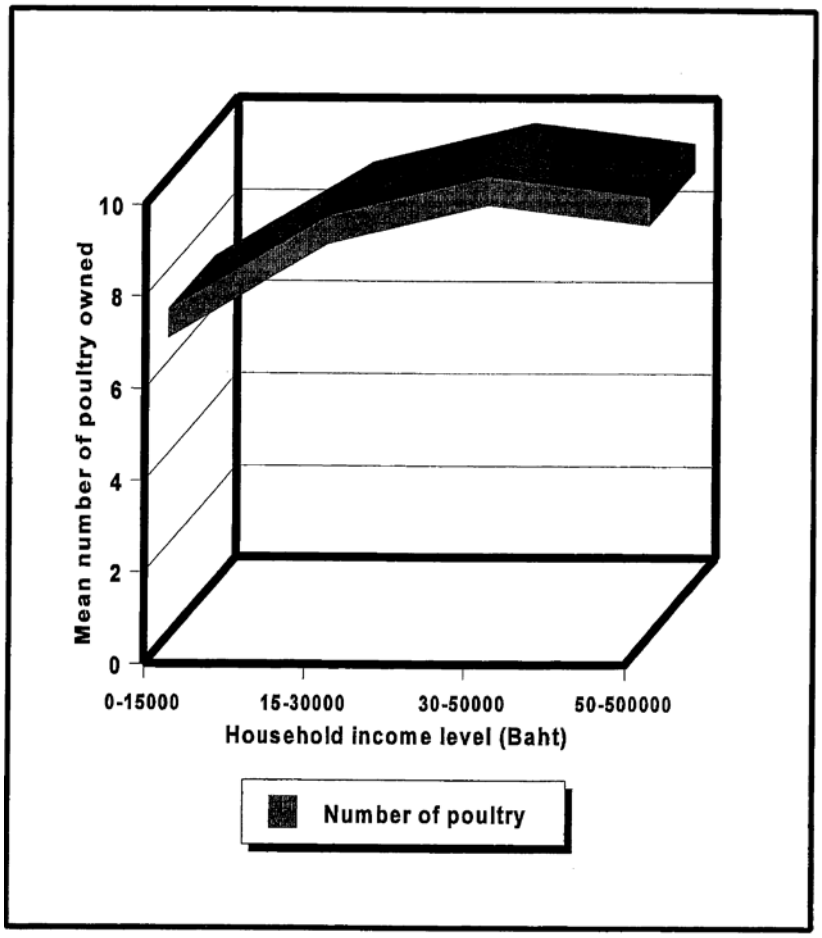


Figure 7: Mean number of poultry across village household income levels (Baht) in Northern Thailand

Table 6 provides information about poultry numbers by village households surveyed in Northern Thailand, but information for 20 households in the sample was not collected. For the 116 households for which information is recorded about poultry, the average number of poultry per household was eight and the median number of poultry possessed by households was 5.5. Most village households had some poultry, but slightly in excess of 15 per cent of households had no poultry at all.

Table 6: Distribution of poultry by households in survey in Northern Thailand

Poultry Numbers	Frequency	Percent	Valid Percent	Cum Percent
.00	18	13.2	15.5	15.5
1.00	3	2.2	2.6	18.1
2.00	4	2.9	3.4	21.6
3.00	17	12.5	14.7	36.2
4.00	8	5.9	6.9	43.1
5.00	8	5.9	6.9	50.0
6.00	9	6.6	7.8	57.8
7.00	6	4.4	5.2	62.9
8.00	6	4.4	5.2	68.1
9.00	7	5.1	6.0	74.1
10.00	4	2.9	3.4	77.6
11.00	4	2.9	3.4	81.0
12.00	6	4.4	5.2	86.2
13.00	1	.7	.9	87.1
14.00	2	1.5	1.7	88.8
15.00	1	.7	.9	89.7
16.00	1	.7	.9	90.5
17.00	1	.7	.9	91.4
20.00	1	.7	.9	92.2
21.00	2	1.5	1.7	94.0
25.00	1	.7	.9	94.8
30.00	2	1.5	1.7	96.6
35.00	2	1.5	1.7	98.3
39.00	1	.7	.9	99.1
86.00	1	.7	.9	100.0
	20	14.7	Missing	
Total	136	100.0	100.0	

Characteristics					
Mean	8.000	Std err	.979	Median	5.500
Mode	.000	Std dev	10.549	Variance	111.287
Kurtosis	26.324	S.E. Kurt	.446	Skewness	4.256
S.E. Skew	.225	Range	86.000	Minimum	.000
Maximum	86.000	Sum	928.000		
Valid Cases	116	Missing Cases	20		

In general, poultry numbers per household were low. Just over 80 per cent of households reported having 12 head of poultry or fewer. However, one household had 86 head and 10 per cent of reported households had 20 head or more. Nevertheless, household production of poultry was on the small side and as will become clear later, was primarily for the purpose of helping to meet subsistence needs.

6.2 Poultry disease and disease prevention

In terms of poultry diseases, Pullorum and Newcastle disease were reported as the most important by approximately 41% of bird owners with other diseases such as avian influenza, fowl pox and external parasites were also mentioned as important (ACIAR 1994).

6.2.1 Statistics

Effect of disease:

No strong dependence was indicated between income level and type of effect of disease on birds. Cross tabulation suggested limited dependence between income levels and the type of effect generated by disease in poultry (Chi square 22.10, sig .57306). Death however was the most prominent effect of disease in poultry.

Treatment:

Analysis of type of treatment of sick birds suggested that 81% of livestock owners do not treat their birds. Treatment is less frequent by villagers in lower income groups than in higher income groups but the difference is not statistically significant (Chi squared 16.517, sig .34854).

Vaccination:

Thai villagers on higher incomes did not show a higher propensity to vaccinate their poultry. Cross-tabulation across income categories suggest there is not a significant difference between income level and the number of Thai villagers who vaccinate their birds.

6.3 Production and accommodation of poultry

The survey outline noted that hens produced an average of approximately 10 eggs per laying period. Most households do not sell chickens (approximately 72.6%) but the remaining 37 households sold an average of 32 birds a year at around about 42 baht per bird (ACIAR

1994). On average those households that slaughter birds for household consumption (99 households), consume 16 birds per year. Consequently, village poultry is a significant source of animal protein in the villages.

Poultry accommodation consists of roaming free (87%), housed at night and free during the day (11.1%) and housed (1.9%)(ACIAR 1994). When birds roam free there is little opportunity to vaccinate them or treat them against disease.

6.3.1 Statistics

Poultry Slaughtered:

A poor linear relationship exists between the number of birds slaughtered for consumption and income level (Figure B 5, Appendix B) (R2 = .0004).

Poultry Housing:

Analysis indicated that the manner in which poultry were housed was in no way related to family income level. Cross tabulation indicated a strong independence between the two variables (Chi squared= 6.76, sig .66120).

Poultry Selling:

While a positive relationship occurs between the number of birds sold and the income level of village households (Figure 6, Appendix B), it was not a strong statistical relationship (R2=.0305).

Poultry Price:

The price received for poultry sold on the market was unrelated to the current economic conditions of the household based on income level (Figure 7, Appendix B) (R2=0.0118).

6.4 Overall observation on poultry

Most of the householders surveyed kept poultry and owned about 7-9 head on average. Practically all the poultry was maintained in a semi-penned state and there was little attention to maintaining the health of flocks. Only 1.9 per cent of poultry was permanently housed, with 87 per cent free roaming and a further 11.1 per cent only penned at night. Under such conditions, it is difficult to practice animal husbandry. Poultry appears to provide an

important animal protein supplement in the diet of Thai villagers and a small cash supplement from market sales.

7. Concluding Comments

In the sample of villagers surveyed in Northern Thailand, there was a high frequency of ownership of bovines, especially cattle, and of poultry but a low frequency of ownership of pigs. In cases where villagers owned livestock, the number owned was as a rule relatively small. It seems that more attention was given to maintaining the health of bovines than of pigs and poultry. This is not surprising because the value of large animals is much greater than small animals, consequently, it pays to invest more in preventing morbidity in cattle and buffalo. There is some evidence to suggest that those on higher incomes are likely to invest more in maintaining the health of their livestock than those on lower incomes. They are also more likely to avail themselves of the DLD services, e.g., the services of the District Veterinary Officer. Variations in the seasonal pattern of grazing of Thai cattle may also have implications for the occurrence of contagious diseases. 'Communal' grazing is most common during the wet season.

Traditional patterns of livestock husbandry appear to persist in the villages surveyed. In the Thai economy as a whole, however, commercial poultry and pig production has expanded rapidly. It seems likely that village pig production has suffered a competitive backlash from commercial pig production. However, village poultry production appears to remain relatively stable and Thailand now has a dual system of poultry production. There has, however, been no significant development in dual beef production. While some cattle feedlots exist, the bulk of Thailand's local supplies of beef come from village production and at the same time, Thailand relies on a substantial and increasing volume of beef imports.

8. Notes

1. The survey stated a Chi square of 16, $P<0.001$ (ACIAR, 1994)
2. Off- farm employment
3. Exchange rate: $1 (AUS) = 19.27 Baht (1996)
4. Metric conversion: 1 Rai = 1,600 m^2

9. References

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Appendix A

Structure of Questionnaire to Village Households in Northern Thailand Owning Livestock as Supplied from Lampang

Structure for table C:\DBASEWIN\PROJECT\CS1\CS1LSOQ1.DBF
Table type DBASE
Number of records 135
Last update 24/11/94

Field	Field Name	Type	Length	Dec	Index
1	PROVINCE	CHARACTER	15		N
2	DISTRICT	CHARACTER	20		N
3	SUBDIST	CHARACTER	20		N
4	VILLAGE	CHARACTER	20		N
5	VILL_NUM	NUMERIC	2		N

1 - 5 Village identification. The village number is a sequential number of that village in the Tambon (subdistrict)

6	NAME	CHARACTER	20		N

Of householder

7	ADDRESS	CHARACTER	40		N
8	HOUSEHOLD	NUMERIC	2		N

Number of people living in household

9	F1_RELAT	NUMERIC	2		N

Relationship code to the interviewer

10	F1_SEX	CHARACTER	1		N
11	F1_AGE	NUMERIC	2		N

In years

12	F1_SCHOOL	LOGICAL	1		N

Does the person attend School?

13	F1_CROPS	LOGICAL	1		N

Is the person involved in working with the crops?

14	F1_ANIMAL	LOGICAL	1		N

Does the person work with the animals?

15	F1_OUTSIDE	LOGICAL	1		N

Does the person work outside the village?

16	F1_OTHER	LOGICAL	1		N

Does the person do any other type of work in the village?

17	F2_RELAT	NUMERIC	2		N

The same for the first 6 memebers of the household.

18	F2_SEX	CHARACTER	1		N
19	F2_AGE	NUMERIC	2		N
20	F2_SCHOOL	LOGICAL	1		N
21	F2_CROPS	LOGICAL	1		N
22	F2_ANIMAL	LOGICAL	1		N
23	F2_OUTSIDE	LOGICAL	1		N
24	F2_OTHER	LOGICAL	1		N
25	F3_RELAT	NUMERIC	2		N
26	F3_SEX	CHARACTER	1		N
27	F3_AGE	NUMERIC	2		N
28	F3_SCHOOL	LOGICAL	1		N
29	F3_CROPS	LOGICAL	1		N

30	F3_ANIMAL	LOGICAL	1	N
31	F3_OUTSIDE	LOGICAL	1	N
32	F3_OTHER	LOGICAL	1	N
33	F4_RELAT	NUMERIC	2	N
34	F4_SEX	CHARACTER	1	N
35	F4_AGE	NUMERIC	2	N
36	F4_SCHOOL	LOGICAL	1	N
37	F4_CROPS	LOGICAL	1	N
38	F4_ANIMAL	LOGICAL	1	N
39	F4_OUTSIDE	LOGICAL	1	N
40	F4_OTHER	LOGICAL	1	N
41	F5_RELATE	NUMERIC	2	N
42	F5_SEX	CHARACTER	1	N
43	F5_AGE	NUMERIC	2	N
44	F5_SCHOOL	LOGICAL	1	N
45	F5_CROPS	LOGICAL	1	N
46	F5_ANIMAL	LOGICAL	1	N
47	F5_OUTSIDE	LOGICAL	1	N
48	F5_OTHER	LOGICAL	1	N
49	F6_RELATE	NUMERIC	2	N
50	F6_SEX	CHARACTER	1	N
51	F6_AGE	NUMERIC	2	N
52	F6_SCHOOL	LOGICAL	1	N
53	F6_CROPS	LOGICAL	1	N
54	F6_ANIMAL	LOGICAL	1	N
55	F6_OUTSIDE	LOGICAL	1	N
56	F6_OTHER	LOGICAL	1	N
57	INCOME	NUMERIC	6	N

Gross household income (considering money only) per year (baht)

58	INCSOURCE1	NUMERIC	2	N

What are your main sources of income, in order of importance? (Give detail of types of crops, types of animals, type of work, source of money)

59	INCSOURCE2	NUMERIC	2	N
60	INCSOURCE3	NUMERIC	2	N
61	EMPLOYCATT	LOGICAL	1	N

Did you employ somebody to look after the cattle over the last year

62	PAYMENTTYP	NUMERIC	1	N

Code for the method of payment (money or calves)

63	PAYMENTAMT	NUMERIC	4	N

Amount that was paid (baht or number of calves)

64	WORKOUTSID	LOGICAL	1	N

Does somebody in the family work outside the village?

65	WORKTOWN	NUMERIC	4	N

Code for the type of place worked

66	WORKTYPE	NUMERIC	2	N

Code for the type of work done

67	LIVEOUT	LOGICAL	1	N

Do they live outside the village?

68	DAYSOUT	NUMERIC	3	N

If they do live outside, howmany days do they live outside teh village (this question got mixed up in the translation, and this is the end result)

69	WORKCHANGE	NUMERIC	1	N

Compared to 5 years ago, how much time do they spend working outside the village now?

70	USEHOME1SP	NUMERIC	1	N

What livestock products to you use at home, in order of importance? This is the species code for the most important product.

71	USEHOME1TY	NUMERIC	1	N

This is the type of product.

72	USEHOME2SP	NUMERIC	1	N
73	USEHOME2TY	NUMERIC	1	N
74	USEHOME3SP	NUMERIC	1	N
75	USEHOME3TY	NUMERIC	1	N

What livestock products do you sell? (as above)

76	SELL1SP	NUMERIC	1	N
77	SELL1TY	NUMERIC	1	N
78	SELL2SP	NUMERIC	1	N
79	SELL2TY	NUMERIC	1	N
80	SELL3SP	NUMERIC	1	N
81	SELL3TY	NUMERIC	1	N
82	LANDOWN	NUMERIC	3	N

How much land do you own?

83	LANDRENT	NUMERIC	2	N

How much land do you rent?

84	LANDUSE1	NUMERIC	2	N

What do you use this land for?

85	LU1AREA	NUMERIC	3	N

What area of land is used for this purpose?

86	LU1FROM	NUMERIC	2	N

From what month is it used in this way?

87	LU1TO	NUMERIC	2	N

Until what month?

88	LANDUSE2	NUMERIC	2	N
89	LU2AREA	NUMERIC	3	N
90	LU2FROM	NUMERIC	2	N
91	LU2TO	NUMERIC	2	N
92	LANDUSE3	NUMERIC	2	N
93	LU3AREA	NUMERIC	3	N
94	LU3FROM	NUMERIC	2	N
95	LU3TO	NUMERIC	2	N
96	EAT_HOT	NUMERIC	2	N

Where do your animals graze or what do they eat during the hot, wet and cool seasons?

97	EAT_WET	NUMERIC	2	N

98	EAT_COOL	NUMERIC	2	N
99	PLOUGH	NUMERIC	1	N

What do you use to work in the rice fields? (This question was made broader in the translation - meaning any source of power for work done in the rice fields)

100	ASKHELP	LOGICAL	1	N

Over the last year, did you ask for any advice about any of your sick animals?

101	ASKHELPWHO	NUMERIC	1	N

Who did you ask?

102	INFO1	NUMERIC	2	N

What other sources of information do you have available to you?

103	INFO2	NUMERIC	2	N
104	INFO3	NUMERIC	2	N
105	INFOAVAIL	LOGICAL	1	N

Are you able to get all the information that you need?

** Total ** 290

Structure for table C:\DBASEWIN\PROJECT\CS1\CS1LSOQ2.DBF
Table type DBASE
Number of records 136
Last update 24/11/94

Field	Field Name	Type	Length	Dec	Index

Fields 1 to 30 are a table of stock numbers owned. The letters in the field name mean B:buffalo, C:cattle; W:work, M:meat, D:dairy; F:female, M:male; L6: less than 6 months of age, 6to3: between 6 months and 3 years of age, M3: more than 3 years of age.

1	BWML6	NUMERIC	3		N
2	BWFL6	NUMERIC	3		N
3	BWM6TO3	NUMERIC	3		N
4	BWF6TO3	NUMERIC	3		N
5	BWMM3	NUMERIC	3		N
6	BWFM3	NUMERIC	3		N
7	BMML6	NUMERIC	3		N
8	BMFL6	NUMERIC	3		N
9	BMM6TO3	NUMERIC	3		N
10	BMF6TO3	NUMERIC	3		N
11	BMMM3	NUMERIC	3		N
12	BMFM3	NUMERIC	3		N
13	CWML6	NUMERIC	3		N
14	CWFL6	NUMERIC	3		N
15	CWM6TO3	NUMERIC	3		N
16	CWF6TO3	NUMERIC	3		N
17	CWMM3	NUMERIC	3		N
18	CWFM3	NUMERIC	3		N
19	CMML6	NUMERIC	3		N

20	CMFL6	NUMERIC	3	N
21	CMM6TO3	NUMERIC	3	N
22	CMF6TO3	NUMERIC	3	N
23	CMMM3	NUMERIC	3	N
24	CMFM3	NUMERIC	3	N
25	CDML6	NUMERIC	3	N
26	CDFL6	NUMERIC	3	N
27	CDM6TO3	NUMERIC	3	N
28	CDF6TO3	NUMERIC	3	N
29	CDMM3	NUMERIC	3	N
30	CDFM3	NUMERIC	3	N
31	OWNEDCATTL	NUMERIC	2	N

How long have you owned cattle or buffalo?

32	CATBOUGHT	NUMERIC	3	N

Fields 32 to 49 refer to changes in animal numbers of the last year.
How many cattle or buffalo have you bought?

33	CATRECEIVE	NUMERIC	2	N

How many have you received as a form of payment?

34	CATSOLD	NUMERIC	3	N

How many have you sold?

35	CATGIVEN	NUMERIC	2	N

How many have you given away as a form of payment?

36	CATBORN	NUMERIC	2	N

How many have been born?

37	CATKILLED	NUMERIC	2	N

How many have you slaughtered for use by the household?

38	CDIEDTYPE1	NUMERIC	2	N
39	CDIEDNUM1	NUMERIC	2	N

The number of cattle or buffalo dying over the last year is broken down into a code for the class of animal, and the number of animals in that class.

40	CDIEDTYPE2	NUMERIC	2	N
41	CDIEDNUM2	NUMERIC	2	N
42	CDIEDTYPE3	NUMERIC	2	N
43	CDIEDNUM3	NUMERIC	2	N
44	BDIEDTYPE1	NUMERIC	2	N
45	BDIEDNUM1	NUMERIC	2	N
46	BDIEDTYPE2	NUMERIC	2	N
47	BDIEDNUM2	NUMERIC	2	N
48	BDIEDTYPE3	NUMERIC	2	N
49	BDIEDNUM3	NUMERIC	2	N
50	CATCHANGE	NUMERIC	1	N

Compared to 5 years ago, how many cattle to you have now?

51	BUFCHANGE	NUMERIC	1	N

As above.

52	PROB1	NUMERIC	2	N

What are the most important problems for your cattle and buffalo?

53	PROB2	NUMERIC	2	N

54	PROB3	NUMERIC	2	N
55	CATDIS1	NUMERIC	2	N

What are the three most important diseases affecting your cattle or buffalo over the last three years, in order of importance?

56	CATTREAT1	NUMERIC	2	N

What treatment did you use? (More like: What did you do about it?)

57	CATCOST1	NUMERIC	3	N

How much did the treatment cost?

58	CATDIS2	NUMERIC	2	N
59	CATTREAT2	NUMERIC	2	N
60	CATCOST2	NUMERIC	3	N
61	CATDIS3	NUMERIC	2	N
62	CATTREAT3	NUMERIC	2	N
63	CATCOST3	NUMERIC	3	N
64	BUFDIS1	NUMERIC	2	N
65	BUFTREAT1	NUMERIC	2	N
66	BUFCOST1	NUMERIC	3	N
67	BUFDIS2	NUMERIC	2	N
68	BUFTREAT2	NUMERIC	2	N
69	BUFCOST2	NUMERIC	3	N
70	BUFDIS3	NUMERIC	2	N
71	BUFTREAT3	NUMERIC	2	N
72	BUFCOST3	NUMERIC	3	N
73	CATSICKL6	NUMERIC	2	N

Over the last year how many cattle less than 6 months old have been sick (including those that died).

74	CATSICKADU	NUMERIC	2	N

How many adult cattle?

75	CATABORT	NUMERIC	2	N

How many cows aborted?

76	BUFSICKL6	NUMERIC	2	N

How many buffalos less than 6 months old?

77	BUFSICKADU	NUMERIC	2	N

How many adult buffalos?

78	BUFABORT	NUMERIC	2	N

How many cows aborted?

79	CATEFFECT1	NUMERIC	2	N

What were the most important effects of disease for your cattle over the last year, in order of importance?

80	CATEFFECT2	NUMERIC	2	N
81	CATEFFECT3	NUMERIC	2	N
82	BUFEFFECT1	NUMERIC	2	N

And for your buffalo?

83	BUFEFFECT2	NUMERIC	2	N
84	BUFEFFECT3	NUMERIC	2	N
85	LASTVACC	DATE	8	N

When were your animals last vaccinated against FMD?

86	CATTLETHEN	NUMERIC	2	N

How many cattle did you have at that time? (This answer generally included pregnant cows and calves under 6 months, who are not eligible for vaccination.)

87	CATTLEVACC	NUMERIC	2	N

How many cattle were vaccinated?

88	BUFTHEN	NUMERIC	2	N

How many buffalo did you have then?

89	BUFVACC	NUMERIC	2	N

How many were vaccinated?

90	WHYNOTVACC	NUMERIC	2	N

If not all were vaccinted, why not?

91	VACCTIME	NUMERIC	3	N

How long did it take to vaccinate your animals?

92	VACCHELP	NUMERIC	2	N

How many other people helped?

93	VACCOTHER	NUMERIC	2	N

Was any other treatment given at the same time? This was intended to be coded as what treatment was given, but with a mix up in translation, it simply ended up as Yes/No.

94	FMDWHATDO	NUMERIC	2	N

What do you do if you hear that there is an outbreak of FMD in the village?

95	WORMTREAT	NUMERIC	1	N

What worm treatment do you use in your cattle and buffalo?

96	WORMWHICH	NUMERIC	2	N

Which animals do you treat?

97	WORMWHEN	NUMERIC	1	N

When do you treat them?

98	COWS3YEARS	NUMERIC	2	N

How many cows over three years of age did you have 3 years ago?

99	CALVES3YRS	NUMERIC	2	N

How many calves have been born over the last 3 years?

100	SELLAGE	NUMERIC	2	N

At what age do you usually sell cattle and buffalo?

101	CAT_PRICE	NUMERIC	5	N

What price do you usually get?

102	HOWSELL	NUMERIC	1	N

How do you sell them?

103	WHENSELL	NUMERIC	2	N

At what times of the year do you sell them?

** Total ** 250

Structure for table C:\DBASEWIN\PROJECT\CS1\CS1LSOQ3.DBF
Table type DBASE
Number of records 136
Last update 24/11/94

Field	Field Name	Type	Length	Dec	Index
1	BOARS	NUMERIC	2		N
How many boars do you have at the moment? etc.					
2	SOWS	NUMERIC	3		N
3	SUCKERS	NUMERIC	3		N
4	GROWERS	NUMERIC	3		N
5	PIGSBOUGHT	NUMERIC	3		N
Over the last year, how many pigs have you bought?					
6	PIGSSOLD	NUMERIC	3		N
Sold?					
7	PIGSKILLED	NUMERIC	3		N
Slaughtered at home?					
8	LITTERBORN	NUMERIC	3		N
How many litters have been born?					
9	PIGSDIED	NUMERIC	2		N
How many pigs have died?					
10	PIGCHANGE	NUMERIC	1		N
Compared to 5 years ago, how many pigs do you have now?					
11	PIGPROB1	NUMERIC	2		N
What are the most important problems for your pigs?					
12	PIGPROB2	NUMERIC	2		N
13	PIGPROB3	NUMERIC	2		N
14	PIGDIS1	NUMERIC	2		N
What are the most important diseases?					
15	PIGTREAT1	NUMERIC	2		N
16	PIGCOST1	NUMERIC	2		N
17	PIGDIS2	NUMERIC	2		N
18	PIGTREAT2	NUMERIC	2		N
19	PIGCOST2	NUMERIC	2		N
20	PIGDIS3	NUMERIC	2		N
21	PIGTREAT3	NUMERIC	2		N
22	PIGCOST3	NUMERIC	2		N
23	PIGLETSICK	NUMERIC	2		N
Over the last year, how many piglets < 2mth have been sick?					
24	PIGSICK	NUMERIC	2		N
How many pigs > 2 mths?					
25	PIGABORT	NUMERIC	2		N
How many pigs have aborted?					
26	PIGEFFECT1	NUMERIC	2		N
What are the most important effects of disease amongst your pigs?					
27	PIGEFFECT2	NUMERIC	2		N
28	PIGEFFECT3	NUMERIC	2		N
29	PIGVACC	NUMERIC	1		N
What vaccines do you give your pigs?					
30	PIGOTHER	NUMERIC	1		N
What other regular treatments do you give your pigs?					
31	HAVESOWS	LOGICAL	1		N
Do you have breeding sows?					

32	SOWS1YEAR	NUMERIC	2	N
How many sows did you have 1 year ago?				
33	AVGLITTER	NUMERIC	2	N
How many piglets do your sows have per litter, on average?				
34	SELLPERLIT	NUMERIC	2	N
How many piglets do you sell per litter?				
35	SELLPIGLET	LOGICAL	1	N
Do you sell piglets for fattening?				
36	PIGLETAGE	NUMERIC	2	N
What age are they when you sell them?				
37	PIGLETPRIC	NUMERIC	3	N
What price do you currently get for them?				
38	BUYPIGLETS	LOGICAL	1	N
Do you buy piglets for fattening?				
39	BUYWHERE	NUMERIC	4	N
Where do you buy them?				
40	PIGLETCOST	NUMERIC	3	N
How much do they currently cost?				
41	PIGSELLAGE	NUMERIC	2	N
What age are they on average when you sell them?				
42	PIGSELLWEI	NUMERIC	3	N
How much do they weigh?				
43	PIGSELLPRI	NUMERIC	3	N
What price do you currently get for them?				
44	PIGSELLPLA	NUMERIC	4	N
Where do you sell them?				
45	NATROOSTER	NUMERIC	3	N
How many native roosters do you have?				
46	NATHEN	NUMERIC	3	N
Native hens?				
47	IMPROOSTER	NUMERIC	3	N
Imported roosters?				
48	IMPHEN	NUMERIC	3	N
Imported hens?				
49	DUCKS	NUMERIC	2	N
Ducks?				
50	GEESE	NUMERIC	2	N
Geese?				
51	BIRDCHANGE	NUMERIC	1	N
Compared to 5 years ago, how many birds do you have now?				
52	BIRDPROB1	NUMERIC	2	N
What are the most important problems for your birds?				
53	BIRDPROB2	NUMERIC	2	N
54	BIRDPROB3	NUMERIC	2	N
55	BIRDDIS1	NUMERIC	2	N
What are the most important diseases for your birds?				
56	BIRDTREAT1	NUMERIC	2	N
57	BIRDCOST1	NUMERIC	3	N

58	BIRDDIS2	NUMERIC	2	N
59	BIRDTREAT2	NUMERIC	2	N
60	BIRDCOST2	NUMERIC	3	N
61	BIRDDIS3	NUMERIC	2	N
62	BIRDTREAT3	NUMERIC	2	N
63	BIRDCOST3	NUMERIC	2	N
64	BIRDEFFEC1	NUMERIC	2	N
What are the effects of disease amongst your birds?				
65	BIRDEFFEC2	NUMERIC	2	N
66	BIRDEFFEC3	NUMERIC	2	N
67	BIRDVACC	NUMERIC	1	N
What vaccines do you give to your birds?				
68	BIRDOTHER	NUMERIC	1	N
What other regular treatments do you give your birds?				
69	EGGSPERLAY	NUMERIC	2	N
How many eggs do your hens usually lay per laying period?				
70	BIRDSELL	NUMERIC	3	N
How many birds do you sell per year?				
71	BIRDPRICE	NUMERIC	2	N
What is the current price per bird?				
72	BIRDKILL	NUMERIC	2	N
How many birds do you kill each year for home consumption?				
73	BIRDHOUSE	NUMERIC	1	N
How are your birds housed?				

** Total ** 159

Appendix B

Additional Graphs of Statistical Data

CONTENTS

Figure B1 - Number of bovine relative to household income levels in Nth Thailand sample.

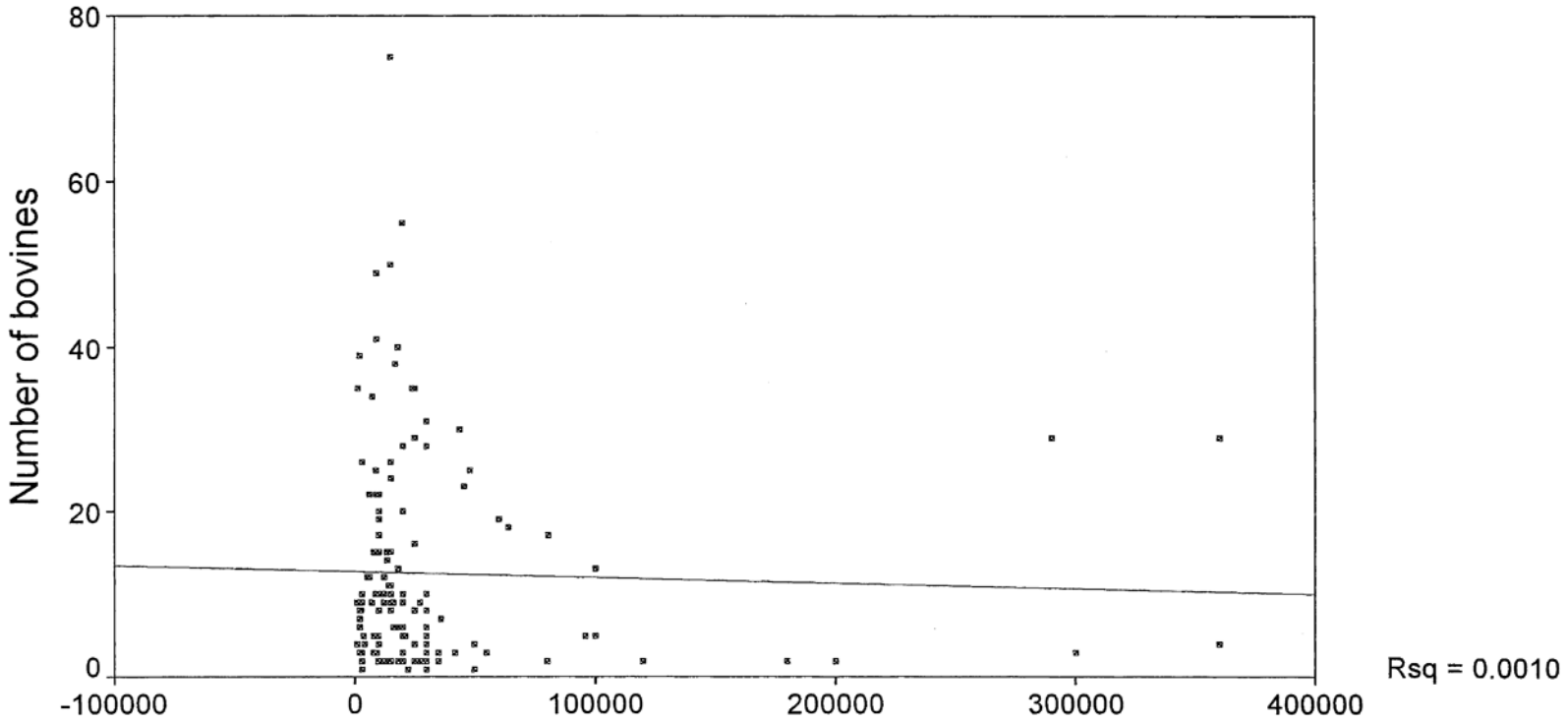


Figure B2 - Pig sickness relative to household income in Northern Thailand survey

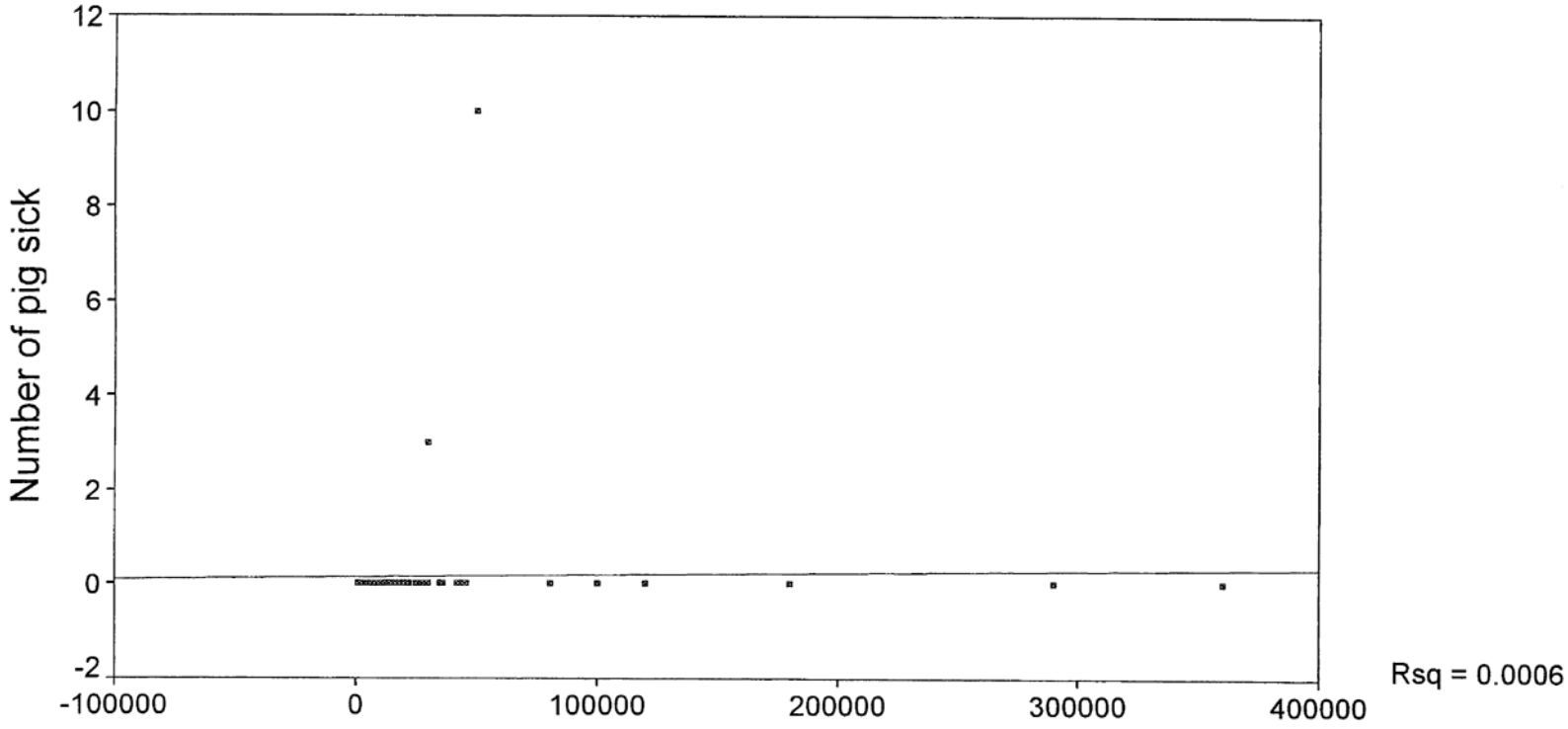


Figure B3 - Pigs sold by households relative to household income in Northern Thailand sample.

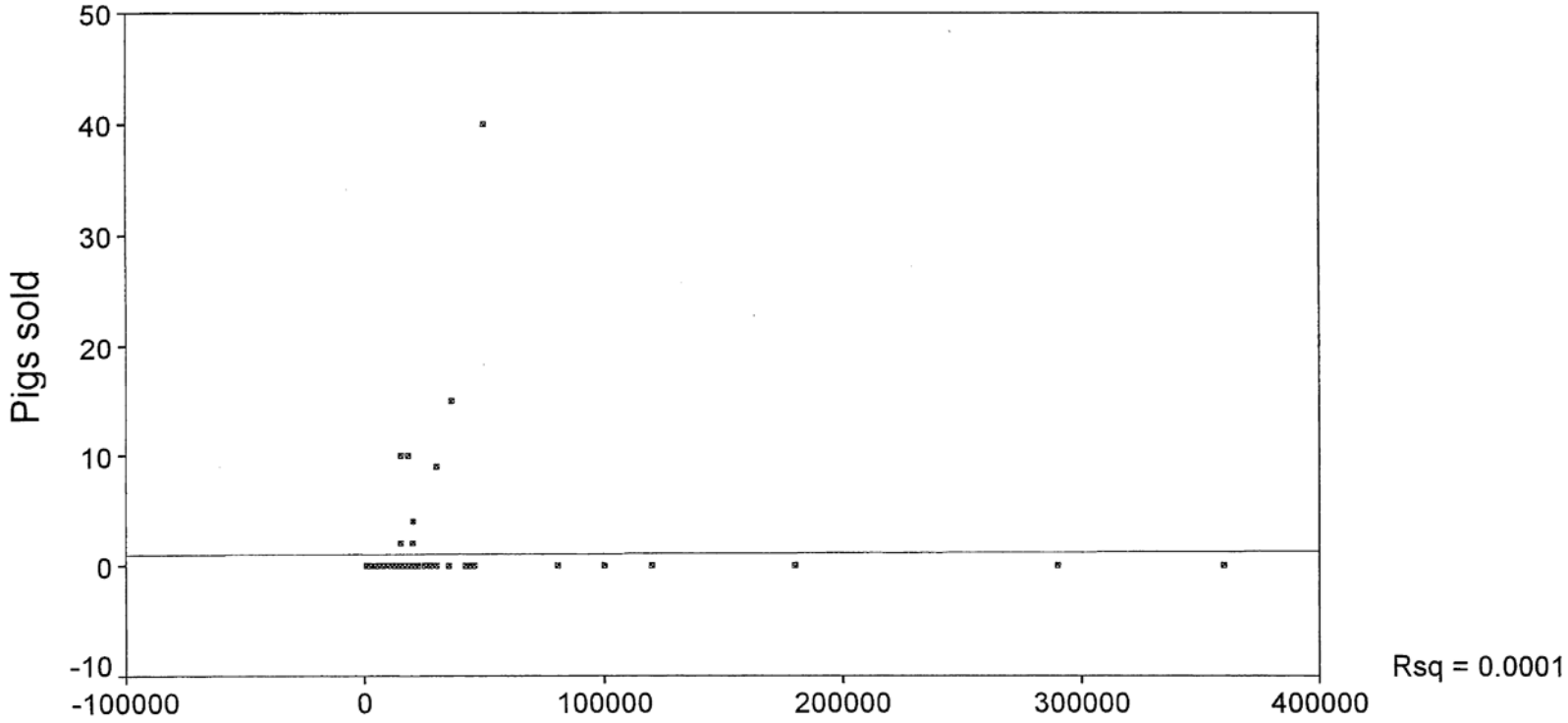


Figure B4 - Poultry numbers by household relative to household income in Northern Thailand survey

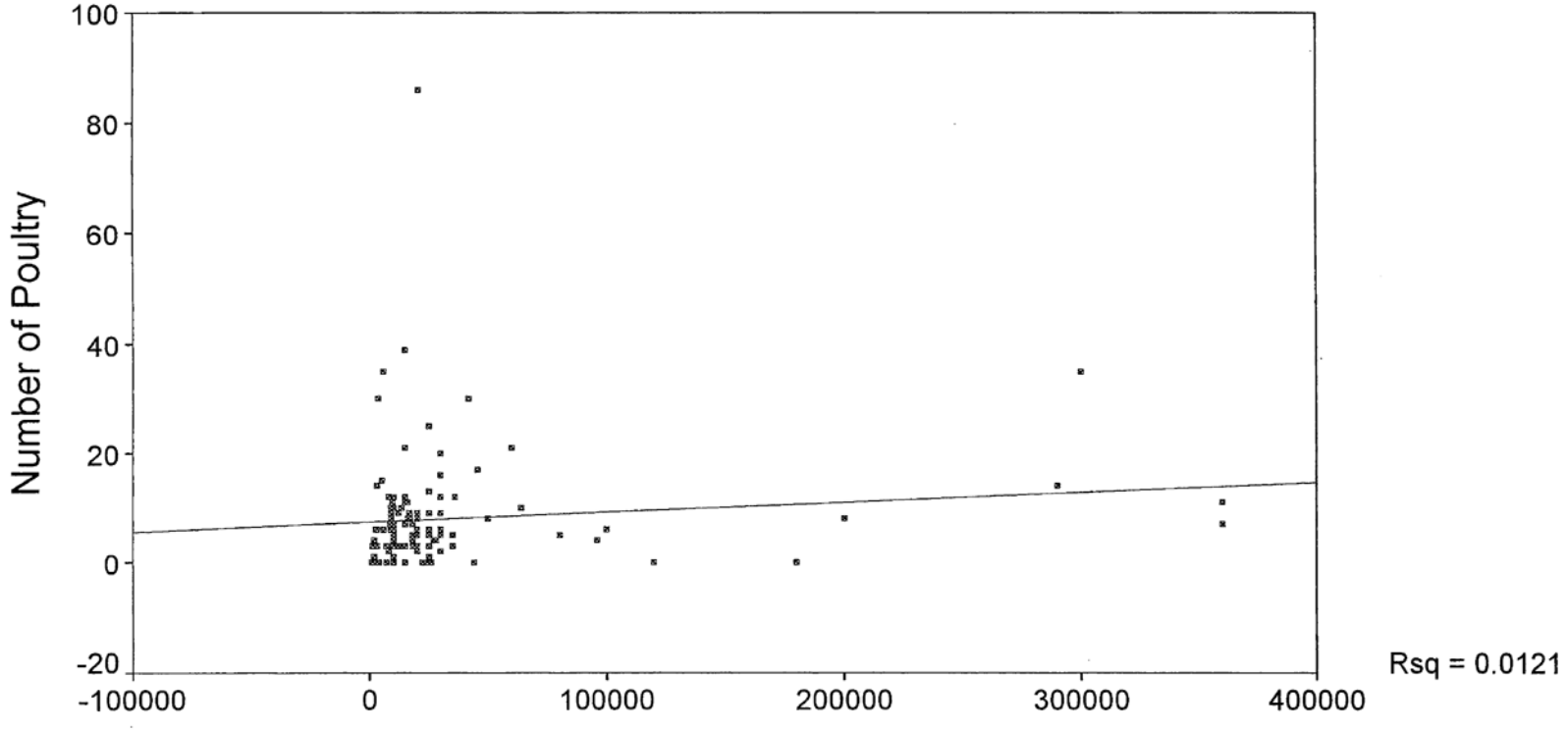


Figure B5 - Poultry slaughtered by households vs household income in Northern Thailand survey.

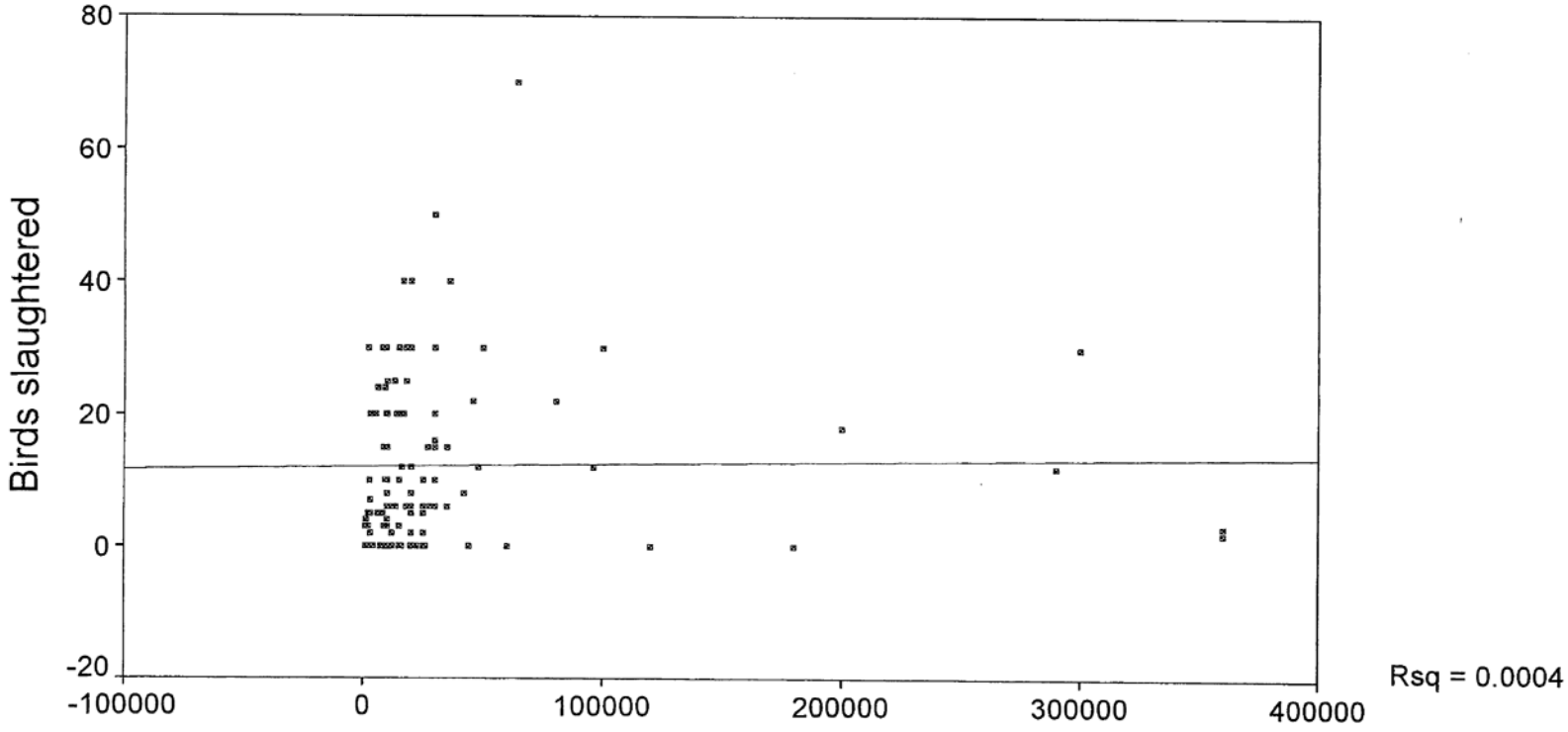


Figure B6 - Poultry sold by households relative to household income in Northern Thailand survey

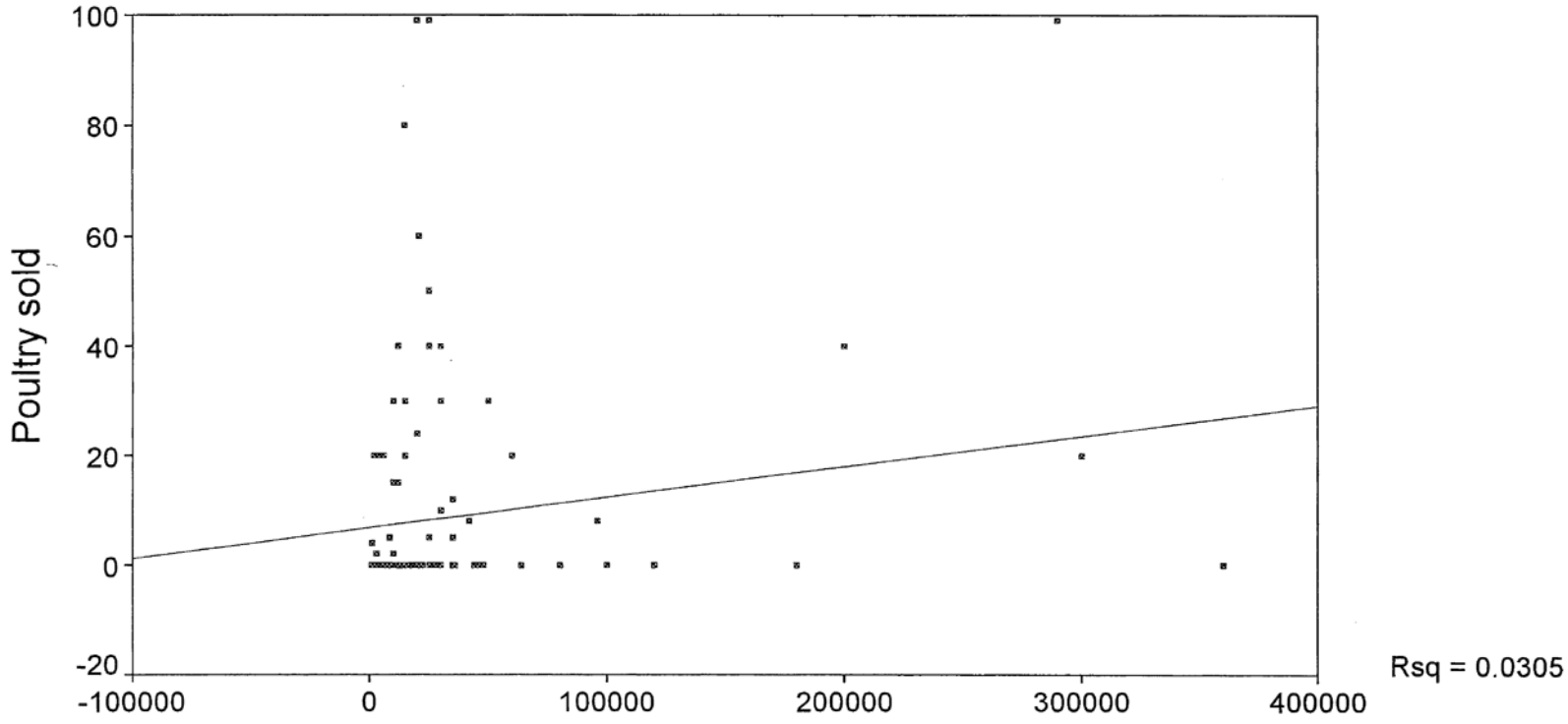
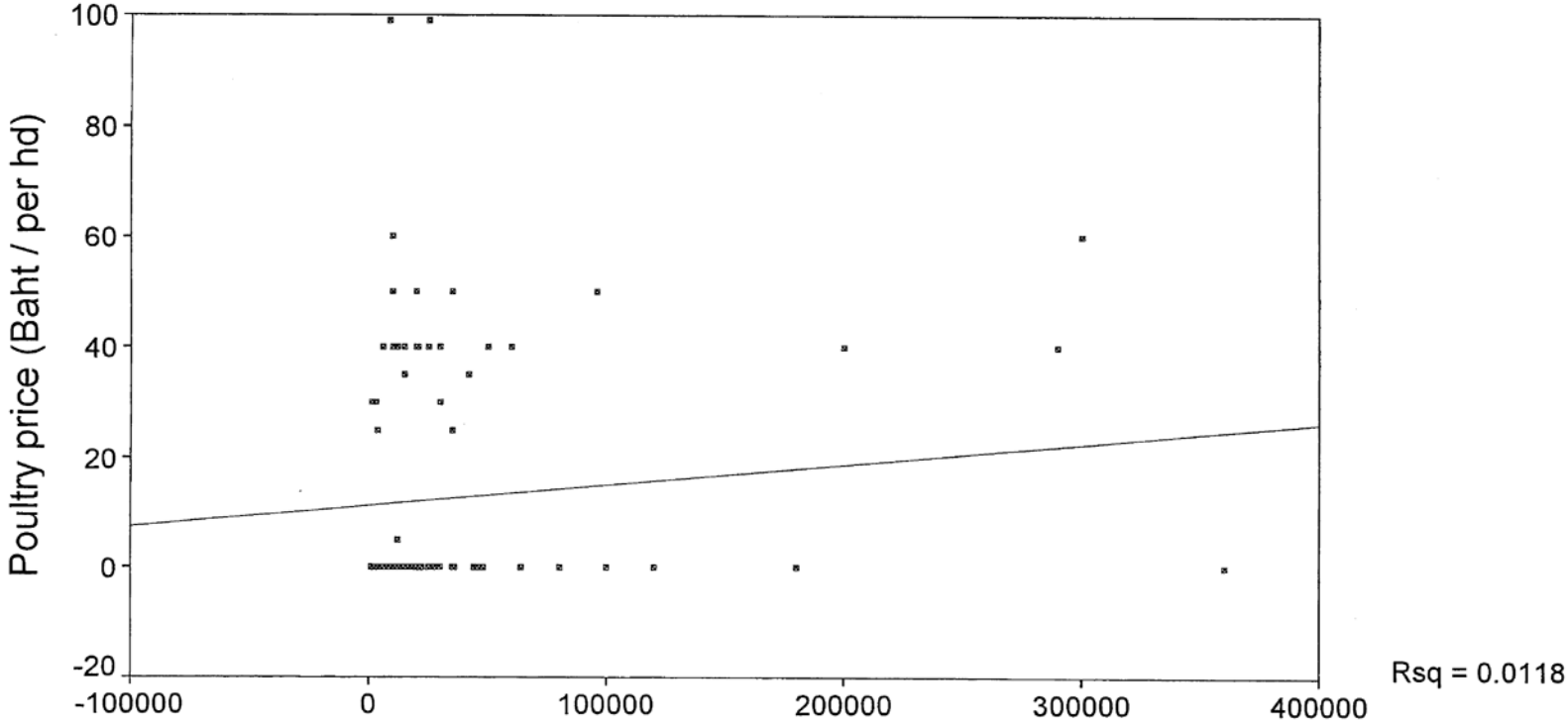


Figure B7 - Poultry price obtained by households vs household income in Northern Thailand survey



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