A LONGITUDINAL ANALYSIS OF CHICKEN PRODUCTION SYSTEMS OF SMALLHOLDER FARMERS IN LEYTE, PHILIPPINES

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Abstract

As part of an aid project on smallholder livestock improvement and innovation in western Leyte, Philippines, a longitudinal study of chicken production systems was undertaken, with the main focus of monitoring the performance of smallholder chicken production systems. This involved the regular collection of data from small scale and scavenging chicken flocks managed by smallholder farmers.

Information on smallholder chicken production in the municipalities of Baybay and Hindang, Leyte, Philippines were generated by using questionnaire-type data collection sheets gathered regularly on a monthly basis from participating smallholder chicken farmers. The data were collected for a period of 18 months and inputted into EpiInfo® version 6.04 database. Descriptive analyses of data collected were undertaken on key performance indicators such as early chick mortality (0-6 week old chicks), post-weaning attrition rate (5 week to 6 month old chickens), hatchability rate, layer efficiency and 6-monthly gross margins of production.

The study found out that smallholder chicken production in the study areas is a semi-scavenging system, with majority of farmers having no housing facilities for their flocks. Data on flock size, attrition, egg production and egg hatchability indicated low productivity, in general. There was also high variability in key variables associated with the time of the year, particularly with changes corresponding to climate, production cycle of the rice cropping systems and special events (such as feasts and holidays). Variations in chicken attrition rates were found to be associated with climatic changes and specific management practices employed (or not employed) by farmers. Also, the rates obtained from the study showed that chick attrition (aged 0 to 6 weeks) accounted for most losses in the chicken flocks. The 6-monthly chicken production data also showed that current production levels are low, with attrition rates reflecting on the gross margins. The study indicates where improvements in the system can be made, such as in reducing early chicken mortality and hatchability.

Keywords

Longitudinal analysis, performance monitoring, smallholder chicken systems

Introduction

The practice of raising chickens in the backyard is very common in most Southeast Asian countries including the Philippines, where it accounts for about 70% of the total poultry population (Ramlah, 2001). Native Philippine breeds make up most (60%) of these backyard chickens (Cocjin, et al., 2003) and the system usually supplements the family diet with protein and provides additional income.

While native Philippine breeds usually have lower productivity than commercial breeds the production of these animals is further constrained by several factors such as high early chick attrition, low hatchability and poor growth rate, all of which respond to improved nutritional, management, financial and general technical inputs (Cocjin, et al., 2003). Low productivity therefore translates to low profitability and efficiency of production.

Some aspects of the current productivity of smallholder chicken flocks in the Philippines using longitudinal methods are described in this paper. While longitudinal studies on smallholder poultry health and productivity have been carried out elsewhere (Janviriyasopak, et al., 1994; Mtambo, 1999; Muhairwa, et al., 2001), a study of this kind including a wide range of indicators, has only been carried out recently in the Philippines (Lañada, et al., 2002). This report related to a preliminary study within the Leyte project reported here. This paper presents results from the same site but for a longer study period.

Research Method
**General study design**

This study formed part of a larger participatory research and development project undertaken over an 18 month period (commencing in late December 2001) of smallholder farmers in the Philippines, with the overall objective of enhancing farmer capacity for improving productivity, profitability, efficiency, and environmental impact of their chicken and pig systems. The project uses the methodology of Continuous Improvement and Innovation (CI&I) as the overriding principle behind all the work in the project (Pym, et al., 2002). Specific objectives for chicken raisers include work on innovations and improvements for profit and efficiency, and creating a farmer-generated information system relevant to their livestock concerns.

This paper presents farmer-generated aspects of biological and economic characteristics relevant to smallholder chicken production, and rates of attrition in these animals in the municipalities of Baybay and Hindang. For the purpose of this study, a smallholder chicken raiser was defined as a small-scale chicken raiser who normally raise chickens for semi-subsistence purposes rather than on a full commercial scale. The farmer’s chicken flock was the unit of interest in this study.

**Sampling and enrolment methodology**

*Selection of municipalities and barangays.* The longitudinal study was undertaken within the municipalities of Baybay and Hindang in Leyte province, Philippines. From each municipality, four barangays (the Filipino term for a small political district) were purposively selected (after considering location and known chicken populations), based on recommendations by the local government livestock officers assigned to the barangays concerned. Criteria for selection included location (the barangays must be accessible from Leyte State University, the project base), political stability (at the start of the project some barangays were known to be affected by an insurgency movement), and willingness of barangay officials to cooperate for the duration of the project.

*Enrolment of farmers.* The reference population for this work included all farmers involved in a larger development project on the enhancement of their capacity to improve productivity, profit, and efficiency of their pig and chicken systems. In each barangay, farmer teams were created, which became the focus of the larger research and development work. For this study, all chicken raisers within the farmer teams were considered eligible for enrolment, and farmers were then selected randomly from the respective teams. Subsequently, a preliminary visit was made to each of these selected raisers to assess their eligibility (according to the previous definition of a smallholder) and willingness to participate in the longitudinal study.

**Data collection, management, and analysis**

A questionnaire was administered to each chicken raiser at the first visit, and answers to general farm-level questions were sought at this time. At this and all subsequent visits the chicken raiser was also asked further animal-specific questions. The questionnaire was used to gather data about those variables that were considered to be related to the productivity, profitability, and efficiency of chicken flocks. The questionnaire was constructed in English, and was subsequently translated into the local language of Cebuano. For the regular monthly data generation activities, a copy of the record sheet was given to participating farmers during each monthly visit. This sheet was collected by the research worker and reviewed with the farmer during the next monthly visit to ensure that all required data was recorded on the form.

Relevant data were recorded on the questionnaire at the first visit and on field data sheets at the first and at all subsequent visits. The information from the study was managed using the relational database capabilities of Epi Info version 6.04c (Centers for Disease Control and Prevention, Atlanta, Georgia, USA). Data analyses were performed using Microsoft Excel 2002 (Microsoft Corporation, Seattle, WA, USA), Statistix version 4.0, and BMDP New System for Windows version 1. The data presented in this study covers the period December 2001 to May 2003.

**Descriptive and comparative analyses**

Standard methods were used to describe data relating to the biological and economic measures of chicken productivity, profit and efficiency. These included frequency distributions, means, medians and 95% confidence intervals. Smoothed 3-monthly averages of attrition rates were presented in graphical form to show patterns and
trends over the study period. Data on economics were presented in 3-monthly totals. Comparisons between different categories of the indicator variables were carried out using one-way analysis of variance.

Most performance indicators relating to the profit and efficiency of chicken flocks were calculated on a monthly basis. These include attrition rates on three age groups (0-6 weeks, 6 weeks to 5 months, older than 5 months), hatchability, and reproductive rate. Due to the inherent difficulties of calculating gross margins on a monthly basis, rates for these were calculated on 3-monthly periods, to correspond to the notional reproductive cycle of smallholder semi-scavenging chickens.

Results and Discussion

General description of the study areas

The study areas are found in the western side of the island of Leyte, a part of the Visayan group of islands in central Philippines. Leyte island is located in the eastern part of the country, the eastern coast of which is the Pacific ocean and the western coast is the Camotes Sea. The climate in the study areas is classified as tropical marine, with two major systems affecting the island, and the country as a whole: the northeast monsoon (November to April), and the southwest monsoon (May to October) (CIA World Factbook, 2003).

Description of farmers

For the longitudinal study, 6 smallholder farmers from each of the four selected barangays in the municipalities of Baybay (Kilim, Hipusngo, Gubang, and Pomponan) and Hindang (HISRA, Tagbibi, Maasin, and Mabagon), for an initial total of 48 farmers, were initially enrolled. However, not all of the 48 farmers raised chickens, and the subsequent withdrawals of some farmers from the study resulted in only 38 farmers visited for 18 months, distributed to 22 farmers from Baybay and 16 farmers from Hindang.

The average age of the participating chicken farmers was 47 years (median 45, range 20 to 72 years). Twenty (52.63%) of the raisers were men. Forty-seven percent (18) of the farmers had attained education at the elementary level, while 10 (26.3%) and 10 (26.3%), had attained secondary and tertiary levels of education, respectively. Most (73.7%) of the participants derived their income wholly from crop farming, with a majority (55.3%) raising rice and/or corn. The majority of farmers (58.8%) planted their crops in either shared, rented, leased, or borrowed land. Twenty-three (60.5%) of the participants also raised pigs together with chickens. None of the farmers in the study utilized their chicken systems as their main source of income.

General description of the smallholder chicken system

Smallholder chicken production in the study areas is a semi-scavenging system, mostly with native Philippine breeds. The majority (26, 68.4%) of farmers had no housing facilities for their flocks. Most of the farmers (27, 71.1%), however, provided some sort of nesting places for their chickens (which could be found inside or near the house, or in rafters of the pigpens) even in the absence of a chicken house. None of the farmers followed regular vaccination and deworming schedules for their chickens.

Reproductive performance of chicken flocks

Flock sizes and other population parameters are found in Table 1. Reproductive performance of the chicken flocks is found in Table 2.

| Table 1. Population characteristics of chickens raised by participating farmers. |
|---------------------------------|-------------------------------|----------------|-----------------|-----------------|
|                                 | n*                           | Mean           | Median         | Range           | 95% CI          |
| Flock size                      | 525                          | 23.13          | 19.00          | 0-143           | 21.18 – 25.086  |
| Mature Males                    | 524                          | 1.63           | 1.00           | 0-17            | 1.39 – 3.41     |
| Hens (Layers and Non-layers)    | 545                          | 4.32           | 1.00           | 0-30            | 3.85 – 4.80     |
| Overall Hen:Male ratio         | 328                          | 3.23           | 1.50           | 0-25            | 2.90 – 3.56     |

* number of monthly visits for which data were available
Table 2. Monthly egg production and reproductive characteristics of the chickens raised by smallholders in western Leyte, Philippines.

<table>
<thead>
<tr>
<th></th>
<th>n*</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg production/farm</td>
<td>525</td>
<td>8.64</td>
<td>2</td>
<td>0-244</td>
<td>7.29 – 9.99</td>
</tr>
<tr>
<td>Eggs production/laying hen</td>
<td>310</td>
<td>5.62</td>
<td>5</td>
<td>0-41</td>
<td>4.95 – 6.28</td>
</tr>
<tr>
<td>Eggs per clutch/hen</td>
<td>198</td>
<td>8.4</td>
<td>9</td>
<td>0-26</td>
<td>7.78 – 9.02</td>
</tr>
<tr>
<td>Set eggs/hen</td>
<td>517</td>
<td>6.31</td>
<td>0</td>
<td>0-80</td>
<td>5.36 – 7.26</td>
</tr>
<tr>
<td>Hatchability (%)</td>
<td>198</td>
<td>67.29</td>
<td>55.56</td>
<td>0-100</td>
<td>57.09 – 77.49</td>
</tr>
</tbody>
</table>

* number of monthly visits for which data were available

The mean flock size of 23.13 (table 1) is in fact larger than the usual flock sizes seen in Africa, but is comparable with the average flock sizes in Madagascar and Mali (Gueye, 1998), where the samples were taken from areas which benefited from a research project. In the case of the farmers in this present study, the relatively large mean flock size and range (0-143) are due to purposive selection of farmers raising chickens and pigs. Also, this study considered young chicks as part of the flock, unlike in some parts of Africa, where owners never include chicks when they refer to flock size, due to very high mortality in this age group (Permin and Bisgaard, 2001). The figures in Table 2, however, reflect very low productivity levels in the study areas. The egg production of 5.62 eggs/hen/month is, however, relatively higher than the figure shown in a study in Bangladesh (Barua and Yoshimura, 1997). Clutch sizes found in this study are very similar to those reported for chickens in Mali (Wilson, et al., 1987).

**Attribution rates**

The rates of attrition of the different age groups are shown in Table 3. The figures show that attrition is highest in the youngest age groups, which accounts for the most losses in the chicken flocks. This is consistent with findings of Muhairwa, et al. (2001) and Mtambo (1999). The results of this study, however, showed lower attrition rates for young chicks, when compared to a study in Tanzania (Muhairwa, et al., 2001). The patterns of attrition, as shown in Figure 1, indicate that most losses of young chicks occur during the southwest monsoon months of May to October. With regards to older chickens (6wks-5mos) and adults (>5mos), the pattern is not very definite.

Table 3. Attribution rates (%) of chickens (categorized by age groups) for the study period.

<table>
<thead>
<tr>
<th>Age groups</th>
<th>n*</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 weeks</td>
<td>351</td>
<td>25.49</td>
<td>11.11</td>
<td>0-100</td>
<td>22.2 – 28.78</td>
</tr>
<tr>
<td>6 weeks to 5 months</td>
<td>394</td>
<td>10.79</td>
<td>0</td>
<td>0-100</td>
<td>8.56 – 13.02</td>
</tr>
<tr>
<td>Mature (&gt;5 mo)</td>
<td>434</td>
<td>2.40</td>
<td>0</td>
<td>0-85.71</td>
<td>1.61 – 3.20</td>
</tr>
<tr>
<td>All ages (average)</td>
<td>431</td>
<td>12.98</td>
<td>4.71</td>
<td>0-100</td>
<td>11.33 – 14.63</td>
</tr>
</tbody>
</table>

* number of monthly visits for which data were available

![Figure 1. Patterns of chicken attrition in the study areas from December 2001 to May 2003. *](image)

* Figures were obtained from smoothed 3-monthly averages. Values are in percentage (%).
Effect of management and climatic changes on attrition

Types of management and climatic conditions were found to have significant effects on early chick (0-6 weeks of age) attrition. These, however, were not significantly associated with attrition rates found in older chickens. With regards to attrition rates of young chicks (0-6 weeks of ages), there were significant differences between different types of management practices (specifically in reference to farm location and chicken housing) and between types of prevailing climatic conditions in the study areas. Young chicks raised in upland areas averaged higher attrition rates (36.3%), compared with chicks raised in lowland areas (17.24%) and in areas with combined lowland and upland features (28.36%) (P=0.0348). This characteristic, however, may be confounded by several factors, notably the relative affluence of the farmers. The main highways in the study areas are found in the lowland areas (where more affluent farmers reside), while the lesser affluent farmers are usually found in areas farther away from the highway, where establishing residences is cheaper. Further, more affluent farmers usually provide better management and care to their chicken flocks.

Early chick attrition was higher (P=0.0013) during the monsoon (habagat) period (30.5%) when the prevailing breeze comes from the southwest, than in those months when the prevailing winds were variable or absent (20.2%). As such, provision of proper shelter for young chicks to protect them against adverse climatic conditions would appear to be beneficial. Results of this study also showed that access to a chicken house had a significant effect on chick attrition rates. Attrition rates of young chicks among farmers who provided housing for their chickens were significantly lower (16.11%) than among farmers who did not provide housing (32.01%) (P=0.0089). This finding is in agreement with results obtained elsewhere, where provision of shelter for young chicks considerably improved survival (Mtambo, 1999).

Gross margins from chicken production

Figure 2 shows the average 3-monthly gross margins obtained by chicken farmers in the study site. Total gross margins reflecting both cash and non-cash expenses, as well as gross margins showing only cash expenses, are presented in the figure. The results show fluctuating gross margins which generally reflects the attrition rates, particularly of growers between 6wks and 5 months, during the different periods. For instance, attrition rates increased between period 1 and period 2. This is reflected in a decline in average gross margins of chicken farmers in these two periods. Between periods 2 and 3, attrition rates for growers 6wks-5months showed a declining trend; gross margins between these periods, on the other hand, increased. Similarly, attrition rates increased between periods 4 and 5, while gross margins declined. In fact gross margins were negative in periods 5 and 6, reflecting losses to chicken farmers. It appears that the attrition rate of growers 6wks-5 months has more influence on gross margins than mortality in the other age groups. This is perhaps because the average cost per unit of bird also increases with the age of the chicks (i.e., losses due to feed costs, veterinary costs, etc will be higher in birds which died at the grower stage compared to losses from birds that died at a younger age). Given that the mean attrition rate for growers was 10.8%, it is not surprising that gross margins are affected.

The longitudinal data showed a decline in chicken production in the area, which was also reflected in the declining trend in gross margins. It is possible that the decline in chicken production was due to farmers shifting to other enterprises and concentrating on other income generating activities such as pig production or crop farming. Since chicken production is mostly a low-input activity and generally not considered a main income source, reduction in production would not greatly affect overall farmer income. In fact, due to the steady decline in the local economy during the study period, farmers were beginning to shift away from livestock production.
and moving towards crop production, mostly rice and coconut. Farm households however still continue to maintain some semi-scavenging chickens, mainly for consumption.

The results of this study therefore show that the overall productivity of chicken systems in the study area is very low. This is a direct result of high attrition in young chickens (which has a direct effect on inventory and value of production and gross margins) and low nutritional, management, and health inputs into the system. The high mortality in very young chickens often results in distorted flock inventories, since most owners do not count chicks as part of the flock because many of these would normally be lost early in life (Permin and Bisgaard, 2001). Improved inputs with regard to nutrition, management and health should help improve farmer capacity to enhance the viability and profitability of their chicken systems. The Research and Development project with smallholder farmers in Leyte, Philippines is focused on this aim by enhancing farmer capacity to improve their chicken production systems using a process of “Continuous Improvement and Innovation” (CI&I) (Clark and Timms, 1999). Through this process, farmers have now started taking action on new innovations and techniques with the aim of increasing the profitability and efficiency and improving the environmental impact of their chicken production systems.

References


