



## The Productivity of Small Animal Species in Small-scale Mixed Farming Systems in Subtropical Bolivia

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### ABSTRACT

The productivity of the scavenging, small animal species (chickens, ducks, pigs, hair sheep and guinea-pigs) commonly found on small-scale farms at the forest margin in subtropical Bolivia was monitored over a full year. Chickens and guinea-pigs were kept mainly for home consumption, while ducks and pigs were kept mainly for sale. Sheep served both purposes, depending upon the family requirements. In the absence of veterinary treatment, the productivity varied greatly between farms. Pigs gave the greatest gross return, but received the largest amount of supplementary feed. Under the existing system, chickens, ducks and sheep all gave similar gross returns per breeding female, although chickens produced good returns and made a large contribution to the family diet where the reproductive efficiency was high and the chick mortality was low. Mortality resulting from disease was a major problem in poultry, while internal parasites appeared to be important limiting factors in pigs and sheep. Guinea-pigs showed no major problems apart from theft, and were an important dietary component for immigrant families from the highlands of the country. Small animal species have largely been ignored by agricultural research and development activities in Bolivia and elsewhere. They currently make significant contributions to the livelihoods of poor people in terms of both income and food security, and this could be greatly increased by simple improvements in animal husbandry.

*Keywords:* chicken, duck, economics, guinea-pig, gross returns, husbandry, pig, productivity, sheep, smallholder

*Abbreviations:* GR, gross return; IV, initial value

### INTRODUCTION

The Bolivian provinces of Sara and Ichilo lie north-west of the city of Santa Cruz, where they occupy about 21 000 km<sup>2</sup>. Some 55% of the total population of 90 000 people live in about 300 rural communities in groups of from 25 to 150 families (Roca, 1998). Overall, immigrants from the highlands of the country make up 46% of the population of the region (Román, 1998).

The foothills of the Andes mountains lie along the southern boundary of the settled area, where it joins the Amboró National Park. Here, the undulating terrain rises to about 800 m altitude, but 85% of the combined area of the provinces comprises flat, alluvial plains. The soils are young and prone to localized, seasonal waterlogging. They

are moderately fertile, with pH values often in the range 4.5 to 5.5. The natural vegetation of the better-drained areas is mostly tall forest. Rainfall increases from 1400 mm in the east to over 1800 mm in the west, about three-quarters of which falls between October and May. In the coolest and driest part of the year (June–July), the minimum temperatures occasionally fall below 10°C during times of southerly winds (Cochrane, 1973; Guzmán, 1982).

Within designated colonization areas, the state assigns blocks of 30–50 ha of forest land to individuals or families for agricultural use. The recipients are usually extremely poor, with access to only a few hand-tools. They initially clear small areas of land to produce staple crops (rice, maize, vegetables, etc.) under a slash-and-burn system. After two or three years, falling soil fertility and increasing weed problems cause the fields to be abandoned to bush regrowth and new areas are cleared. As more land is used, the period between the cropping cycles is reduced. Ultimately, the system becomes unsustainable and many farmers then turn either to the introduction of permanent crops (citrus, bananas, etc.) or to the establishment of pastures for cattle. Once land titles are obtained, some sell their land to neighbours who consolidate holdings in order to mechanize their farming operations. The vendors then take up new blocks further into the forest, where they start again (Thiele, 1991).

In 1992, it was estimated that 74% of the farm families in the region had total annual incomes below US\$1100, with 25% of them receiving less than US\$300 (Roca, 1998). While improved prices for rice have increased incomes in recent years, they are still very low and capital accumulation is difficult. Even where the eventual aim is to produce milk, small animal species, principally chickens, ducks, pigs, guinea-pigs and tropical hair sheep, enter the farming system at an early stage, being attended mainly by women and children (Román, 1998).

Scavenging, local breed chickens are present on over 90% of the farms in the region (Román, 1998) and local ducks are also common, particularly on farms owned by lowland people and with a stream flowing close to the house. All poultry scavenge for their food, eating foliage, together with worms and insects obtained along the banks of the stream. They receive no veterinary treatment and have to make do with whatever shelter they can find close to the homestead.

It is common in the region to find one or two local breed sows on farms belonging to local or immigrant people, although relatively few farmers keep mature males. Most owners appear to rely on the loan of a boar from relatives or neighbours and this procedure facilitates controlling breeding. Pigs usually scavenge around the farm, being tethered or confined in simple pens at night or when it is feared that they might damage crops.

Tropical hair sheep are a relatively recent introduction into the area, the Brazilian breed Santa Inéz having been promoted by research entities and NGOs over the past decade as a more productive alternative to the common wool sheep (Bentley *et al.*, 1998). Under tropical conditions, where both the demand for and price of wool are low, the higher prolificacy of hair sheep should increase the financial return to farmers. Sheep and guinea-pigs are kept exclusively by immigrants from the highlands.

Despite the popularity of these animal species, several of which are actively promoted by a range of NGOs, little information is available regarding their actual or

potential productivity. The present work was undertaken to measure their contribution to the system and to identify the major production problems.

## MATERIALS AND METHODS

Eleven farms were chosen, located in four distinct communities. Farms 1–5 were located in the community of Barrientos, and farms 6 and 7 in San Rafael. Both of these communities are made up of immigrants from the highlands of Bolivia. Farm 8 was in San Miguelitos and farms 9 and 10 were located in Potrerito, communities that are inhabited entirely by lowland families. The communities were selected as being representative of the area in terms of the existing farming systems, origin and age of the inhabitants, and access to infrastructure and technical assistance. Because of the degree of homogeneity observed within each of the communities chosen, it was not thought necessary to take objective measures to ensure that the individual farms were representative of their communities. Instead, the important selection criteria used were the presence of small animal species and family experience in keeping them, together with an expressed interest in small livestock and willingness to cooperate in the work over an extended period. Despite these precautions, one farmer dropped out of the project after a few months of participation, leaving 10 to be considered.

At the commencement of the work, an initial inventory was made of each species on the farm and the animals were individually identified with numbered tags. A separate notebook was prepared for each animal species, in which the farm family was to record events as they occurred. Initially, technical staff visited each farm at about weekly intervals to ensure that full recording was taking place. Subsequently, as the collaborators became used to the system, the technical visits were made on a fortnightly basis. The data recorded included births, deaths, sales, consumption, exchanges, health measures, feed offered and owners' observations. Recording took place over a full year so as to include any effects due to season. Intermediate and final animal inventories were made to obtain information on the dynamics of the system and to check that the recording was going according to plan. Preliminary results were processed after the first few months (Ugarteche *et al.*, 1998), while the results from the full year are presented here.

The initial value (IV) of the flock or herd was calculated for each species, using commercial prices reported by the farmers themselves. Separate prices were used for young, immature and adult animals of breeding age. The gross return for a species was calculated, using these prices, as the sum of the values of: (i) changes in the inventory over the monitoring period (final minus initial value in each category); (ii) home consumption of animal products (eggs and meat); (iii) net commercial operations (value of sales less cost of purchases). Gifts and exchanges of small animals were not common features of the system under study but, where they occurred, they were considered as sales or purchases respectively and costed at market price.

The gross return was expressed first as a cash figure and then relative to the value of the initial inventory and also to the number of breeding females at the start of the monitoring period. All financial figures were converted to US dollars using an exchange rate averaged over the 12 months of the monitoring period.

During the course of the study, a participatory rural appraisal was conducted on each farm to provide socioeconomic data for characterizing the farm and assessing the farmers' attitudes and aspirations (Chamón, 1999). The farmers valued these studies, both for their potential as official documents to assist in obtaining land titles, loans, etc. and also as medium-term farm development plans. Subsequently, the individual studies were subjected to a combined analysis in order to draw more general conclusions (Chamón *et al.*, 1999).

## RESULTS

### *Chickens*

These animals were occasionally fed some household scraps or cracked grain but received no veterinary attention or vaccinations. They often roosted at night in trees near to the house. On most farms, eggs were collected for home consumption and occasional sale in almost all months of the year, the maximum harvest commonly occurring in the period from August to November. Chicks hatched throughout the year, with most generally appearing in the period from May to July. Overall, the annual productivity was 5.8 chicks hatched per mature hen, although the obvious trade-off between harvesting eggs and leaving them to hatch led to great variation between farms in the apparent reproductive efficiency. Typically, the annual sum of eggs collected and chicks observed (net egg production after losses to weather and predators) ranged from 20 to 40 per breeding female. A number of natural predators took both eggs and newly hatched chicks, but losses of older birds in this way were minimal. In the absence of either vaccinations or treatments, the heaviest mortality of chicks resulted from disease, aggravated by cold or wet weather. Work is in progress to identify the most common diseases, but detailed results are not yet available.

Although few birds were sold, young males and older females were slaughtered throughout the year for home consumption, at rates of from two to four birds per month.

Data on reproduction, chick mortality and financial return are presented in Table I.

### *Ducks*

The productivity of this species under scavenging conditions is summarized in Table II. No eggs were laid in the colder months from May to July and the females bred only once per year. Most ducklings hatched between October and March and disease was the greatest cause of mortality of ducklings. No loss to predators was recorded, although on one farm two older birds died after being trampled by cows. There was no routine home consumption of either duck eggs or meat, although occasionally a bird was slaughtered for a family celebration. There was a ready market for live or dressed birds, which often found their way to restaurants in the urban centres. Most were sold at an agreed price, rather than by weight. Financial data are included in Table II.

TABLE I  
Productivity of chickens over a period of 12 months

Farm number and community	Productivity data				Financial data (US\$) <sup>a</sup>			
	Initial no. of females	No. of clutches	Chicks per clutch	Mortality of chicks (%)	Initial value (IV)	Gross return (GR)	GR as % of IV	GR per breeding female
1. Barrientos	7	7	7.9	48.0	80.00	140.55	176	20.08
6. San Rafael	24	12	7.5	68.9	184.55	107.09	58	4.46
7. San Rafael	15	7	7.1	8.0	144.55	127.09	88	8.47
8. San Miguelitos	13	16	6.8	19.0	103.64	286.18	276	22.01
9. Potrerito	12	6	5.8	20.0	76.36	106.36	139	8.86
10. Potrerito	5	14	7.1	12.0	49.45	242.73	491	48.55
Total or average	76	62	7.1	30.5	638.55	1010.00	158	13.29

<sup>a</sup>Exchange rate was US\$1.00 equivalent to bolivianos (Bs) 5.50

TABLE II  
Productivity of ducks over a period of 12 months

Farm number and community	Productivity data				Financial data (US\$) <sup>a</sup>			
	Initial no. of females	No. of clutches	Ducklings per clutch	Mortality of ducklings (%)	Initial value (IV)	Gross return (GR)	GR as % of IV	GR per breeding female
8. San Miguelitos	6	5	6.4	78.1	45.45	25.45	56	4.24
9. Potrerito	6	6	7.0	35.7	87.27	119.09	136	19.85
Total or average	12	11	6.7	54.1	132.72	144.54	109	12.05

<sup>a</sup>Exchange rate was US\$1.00 equivalent to bolivianos (Bs) 5.50

### *Pigs*

Despite the lack of boars on most farms, the average period between farrowings was calculated to be 265 days. Litters were concentrated in the period from April to June and again from September to November. Losses of piglets were generally high and were attributed by farmers to accidents (crushing, drowning), cold weather and lack of maternal milk. It seems likely that internal parasites were implicated in a number of deaths, since on farm 8, where the animals were treated against parasites, the losses were greatly reduced.

The fallen fruits from naturally occurring palm trees (*Attalea* and *Scheelea* spp.) formed an appreciable part of the diet of pigs, together with worms and roots scavenged from the banks of water courses. The natural diet was supplemented by a range of materials produced on the farm, including cassava tubers, chopped sugar cane and vegetable wastes.

Young animals of up to about 40 kg liveweight were in great demand, particularly at times of public holidays (carnival, Easter, Christmas) and for major family celebrations. Of a litter of piglets, one or two may be consumed within the family, but most were sold for cash income. Productivity and financial data are presented in Table III.

### *Sheep*

Animal numbers were low and it is premature to draw firm conclusions, although preliminary data are presented here. The animals had access to poor-quality, volunteer grazing on fallow land. They received neither supplementary feeding nor veterinary attention. Under such conditions, twinning was common, but the lambing frequency was less than once per year on three of the four farms studied. The overall lambing interval can be tentatively estimated at 512 days. Mortality in young animals was high and was attributed by the farmers to accidents and to lack of maternal milk, although internal parasites could well have been implicated in poor lactation. Some farmers complained of difficulties in marketing animals for slaughter, although others stated that it is easy to sell young stock for breeding purposes. Some animals were consumed on the farm at times of family celebrations. The productivity of the small flocks is shown in Table IV.

### *Guinea-pigs*

This species was monitored at only one site (farm 5, Barrientos community). From an initial group of 17 breeding females, 25 litters were produced in the year (average 190 days *inter partum*), with an average of 2.28 live births per litter and mortality of 10.5%. An initial inventory valued at US\$77.27 produced a gross return of US\$81.82 (106% of IV), for a return per initial mature female of US\$4.81. Productivity and returns were severely affected by the theft of 20 semi-mature animals in the seventh and eighth months of the study. It may be conservatively estimated that, had this not occurred, the

TABLE III  
Productivity of pigs over a period of 12 months

Farm number and community	Productivity data				Financial data (US\$) <sup>a</sup>			
	Initial no. of females	No. of litters	Piglets per litter	Mortality of piglets (%)	Initial value (IV)	Gross return (GR)	GR as % of IV	GR per breeding female
1. Barrientos	3	2	8.5	41.2	292.73	216.36	74	72.12
2. Barrientos	1	1	12.0	66.7	269.09	161.82	60	161.82
7. San Rafael	1	2	7.5	65.2	283.64	395.45	139	395.45
8. San Miguelitos	3	6	6.3	10.5	927.27	1309.09	141	436.36
Total or average	8	11	8.1	38.2	1772.73	2082.72	117	260.34

<sup>a</sup>Exchange rate was US\$1.00 equivalent to bolivianos (Bs) 5.50

TABLE IV  
Productivity of hair sheep over a period of 12 months

Farm number and community	Productivity data				Financial data (US\$) <sup>a</sup>			
	Initial no. of females	No. of lambings	Lambs per lambing	Mortality of lambs (%)	Initial value (IV)	Gross return (GR)	GR as % of IV	GR per breeding female
3. Barrientos	4	3	1.00	33.3	203.64	43.63	21	10.91
4. Barrientos	7	6	1.33	37.5	356.36	130.91	37	18.70
6. San Rafael	11	7	1.14	25.0	432.73	104.18	24	9.47
7. San Rafael	3	5	1.40	28.6	163.64	64.55	39	21.52
Total or average	25	21	1.24	30.8	1156.36	343.27	30	13.82

<sup>a</sup>Exchange rate was US\$1.00 equivalent to bolivianos (Bs) 5.50

gross return would have been almost doubled to about US\$151 (195% of IV) for a return per initial mature female of US\$8.91.

## DISCUSSION

As may be expected in a study of this nature, there were large differences between both animal species and farms in terms of reproductive efficiency, mortality of young animals and financial returns. There were few apparent differences in terms of production system and farm infrastructure, although the attention paid to animal management was clearly an important determinant of performance. In view of these considerations, and the small number of animals involved, no attempt was made to analyse the results statistically.

### *Animals for home consumption*

With chickens, the number of clutches left to hatch was often influenced by the availability of grain on the farm, which in turn was determined by the weather in individual seasons. The annual average number of chicks produced per mature hen, a combined measure of reproductive efficiency, varied widely between farms. The extremes, ranging from 2.9 (farm 9) to 19.9 (farm 10), were registered in the same community (Potrerito). This measure is affected by a number of variables, including the numbers of eggs laid and the proportion taken by the family or destroyed by predators and adverse weather conditions. Each of these variables is, in turn, governed by other factors such as the birds' genotype and nutrition, human family size and health, and location of the farm in relation to refuges for animals that prey on the eggs. In general terms, hens on farms belonging to immigrants (farms 1, 6 and 7) had fewer but larger clutches of eggs than their counterparts owned by lowlanders (farms 8, 9 and 10). This may reflect differences in feeding policies.

Once the eggs hatch, a major consideration is survival. Again, great differences were seen between neighbouring farms, particularly in the community of San Rafael. Even though neither used formal veterinary treatments, farm 6 suffered 69% chick mortality, largely due to diseases, while farm 7 recorded only 8% losses. Although the best results were obtained by an immigrant farmer (farm 7), she was a graduate from an agricultural school and had received formal training in poultry husbandry. Other farmers from her region of origin suffered extremely high losses in comparison with lowland farmers. It would appear that simple management practices, including attention to detail and home remedies, are capable of bringing losses well below 20%. Basic attention to animal health, including vaccination against Newcastle disease and appropriate treatment for diarrhoea, as recommended by local veterinary authorities, should reduce mortality still further. Work is currently in progress to measure the effects of these interventions.

The annual sum of eggs collected and chicks produced in the area under study, in the range of 20 to 40 per breeding female, agrees closely with data presented by Rushton and Ngoni (1998) for scavenging-based poultry systems in Africa.

Given the observed variation between farms in both reproduction and mortality, it is little wonder that the financial return from chickens varied by an order of magnitude between the best and the worst performers. Nevertheless, no farmer obtained production valued at less than US\$100 per year from a small flock of scavenging chickens. While little of this was in cash income, the nutritional value to the farm family of consuming some 20 eggs and 2–4 chickens per month is obvious.

Guinea-pigs are also kept mainly for home consumption. Although they live confined within farm buildings and fresh fodder must be cut daily, the quantity required is small and the labour requirement for this purpose is minimal. They are prolific (average 4.4 live young produced per breeding female per year) and, apart from the danger of theft, they appear to be completely problem-free. While the potential return from chickens may be higher when chick mortality is well controlled, and the birds produce both eggs and meat, guinea-pigs are a viable alternative where poultry suffers from disease problems. Cooperators have commented that the effort of preparation and time needed for cooking these animals is much less than for chickens, resulting in savings of both time and fuel wood. Guinea-pigs are not yet an accepted part of the diet of lowland people, since they originated in the Andes, where they form an integral part of traditional, highland cuisine. Nevertheless, they offer an easy, alternative, home-produced food of high nutritional quality, which could become more important in the future.

#### *Animals for sale*

On average, scavenging ducks bred only once per year, producing 6.7 ducklings per clutch. Mortality was high, resulting primarily from accidents or diseases, so the gross returns per breeding female were modest (Table II). Because home consumption was limited, most of the returns were available as cash.

The scope for some degree of intensification in the rearing of ducks was shown by one farmer who was not included in the present study. On her holding, close to the urban centre of Portachuelo, she had independently developed her own system, with no advice from the extension services. Ducklings were removed from the mother as soon as they hatched. The ducklings were kept indoors for the first few days, after which they were moved to a sheltered enclosure outside. At about 4 weeks, they moved to a larger pen where, after a further month, they entered a finishing area before being sold according to weight at about 3 months of age. They were fed on commercial meal and vegetable scraps bought from the local market. Under this system, where they were protected from accidents, there was almost no duckling mortality, even in the absence of veterinary treatment. Despite high feeding costs, the system was profitable because of its high reproductive efficiency and low duckling mortality. In the 4-month period from early August 1997, the gross margin of this backyard enterprise, after considering feed costs, was estimated at US\$47.12 where labour was costed commercially, or US\$96.04 where labour was not included. This equates to a gross annual return (excluding labour) of about US\$48 per breeding female, four times the average return calculated for scavenging birds. The profitability of the enterprise could be further

increased if the purchased feed were replaced by home-grown crops such as maize and *Mucuna pruriens*.

Sows in this region farrow once or twice per year and mating is often timed to provide animals for sale in holiday seasons. Typically, the litters consist of eight piglets, but often four die before weaning. These data are in close agreement with those obtained by Wilkins and Martinez (1983) from similar production systems in the Chané area of Bolivia. On two farms where the sows farrowed twice per year, annual gross returns per sow of about US\$400 were obtained.

The established productive potential of hair sheep in the target area region was disappointing, largely due to a combination of long *inter partum* intervals and high lamb mortality. These factors were worse in Sara and Ichilo than had been previously observed, either on small farms in the Chané region with a high degree of technical assistance (Bentley *et al.*, 1998), or on a commercial ranch in San Javier without professional attention (Wilkins *et al.*, 1983). In both of these studies, adequate control of internal parasites was emphasized as a prerequisite for high animal productivity. There would appear to be scope for improving the productivity of this species in the target area through the implementation of currently available veterinary recommendations.

#### *Contribution to the system*

Farms in the region typically kept two or three of the small animal species discussed above. Chickens for home consumption are almost ubiquitous, while ducks, pigs and hair sheep are commonly kept for sale. Under present conditions, a normal flock of about 12 chickens will contribute food worth some US\$150 per year to the family larder. The normal holding of six breeding ducks will provide some food to the family, together with an annual income of about US\$60, while five ewes will produce a lamb for the table and about US\$50 in cash. A single sow farrowing twice in the year will provide two pigs for home consumption and an income of at least US\$300.

The productive performance of small animals can be put into perspective when it is considered that the daily wage for an unskilled manual labourer in the region is about US\$5.00 per day. In the unlikely event that work could be found all year round, this would equate to a maximum cash income of about US\$1200. On the averages recorded in the present study, a gross return equal to this figure would be generated by 90 hens, 100 ducks, 5 sows, 87 ewes or 135 female guinea-pigs, or by combinations of smaller numbers of these animals.

In the current situation, where the annual cash income of at least half of the farm families is probably close to US\$1000, the contribution of scavenging livestock is obvious. These species, which have largely been ignored by both research and development organizations in the past, deserve greater efforts to overcome the obvious problems they confront. With more attention, particularly to health and management issues, they should be capable of making an even greater contribution to farm income and human welfare in the Bolivian tropics.

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## REFERENCES

- Bentley, J., Iñiguez, L. and Henderson, S., 1998. *Evaluation of the Impact of the British Tropical Agricultural Mission (BTAM) to the Centro de Investigación Agrícola Tropical (CIAT), Santa Cruz, Bolivia*, (Department for International Development (DFID), London)
- Chamón, K., 1999. *Diagnósticos Participativos de Doce Sistemas de Producción en las Provincias Sara e Ichilo*, (Centro de Investigación Agrícola Tropical (CIAT), Santa Cruz, Bolivia), Mimeo
- Chamón, K., Joaquín, N. and Paterson, R., 1999. *Síntesis y Análisis de Diagnóstico Participativos con Productores de Pequeña Escala en las Provincias Sara e Ichilo*, (Centro de Investigación Agrícola Tropical (CIAT), Santa Cruz, Bolivia)
- Cochrane, T.T., 1973. *El Potencial Agrícola del Uso de la Tierra en Bolivia. Un Mapa de Sistemas de Tierras*, (Editorial Don Bosco, La Paz, Bolivia)
- Guzmán, A., 1982. *Uso Potencial de la Tierra en el Departamento de Santa Cruz*, (Corporación Regional de Desarrollo de Santa Cruz (CORDECRUZ), Santa Cruz, Bolivia)
- Roca, C., 1998. Contexto de la realidad de los sistemas de producción de los pequeños productores en la micro-region Ichilo-Sara. In: *Metodologías de Investigación Pecuaria en Sistemas de Producción de Pequeños Productores: seminario taller internacional*, (Centro de Investigación Agrícola Tropical (CIAT), Santa Cruz, Bolivia), 7–17
- Román, M.A., 1998. *Influencia Cultural en el Desarrollo Agropecuario de los Pequeños Productores de Santa Cruz*, (Thesis, Facultad de Ciencias Económicas y Sociología, Universidad Mayor de San Simón: Cochabamba, Bolivia)
- Rushton, J. and Ngongi, S.N., 1998. Poultry, women and development: old ideas, new applications and the need for more research. *World Animal Review*, **91**, 43–48
- Thiele, G., 1991. *The Barbecho Crisis: Revisited*, (Technical Report No. 1; Centro de Investigación Agrícola Tropical (CIAT)/British Tropical Agriculture Mission (BTAM), Santa Cruz, Bolivia)
- Ugarteche, J., Paterson, R.T. and Joaquín, N., 1998. *Especies Menores en Sistemas de Producción de Pequeños Productores, Provincias Sara e Ichilo*, (Centro de Investigación Agrícola Tropical (CIAT), Santa Cruz, Bolivia)
- Wilkins, J.V. and Martínez, L., 1983. Bolivia: an investigation of sow productivity in humid lowland villages. *World Animal Review*, **47**, 15–18
- Wilkins, J.V., Hook, S., Rachman, M. and Leslie, J., 1983. *The Role of Sheep in Small Farm Development in the Bolivian Lowlands*, (Documento de Trabajo No. 30; Centro de Investigación Agrícola Tropical (CIAT)/British Tropical Agricultural Mission (BTAM), Santa Cruz, Bolivia)

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### **Productivité des petits animaux élevés en systèmes mixtes de petite taille dans la partie sub-tropicale de la Bolivie**

**Résumé** – La productivité des charognards petite taille (poulets, canards, cochons, moutons et cochons d'Inde) habituellement élevés dans les fermes de petite taille, sur les abords de la forêt en Bolivie sub-tropicale, ont été suivis pendant un an. Les poulets et les cochons d'Inde étaient élevés pour l'alimentation dans la ferme alors que les canards et les cochons étaient élevés pour être vendus. Les moutons étaient élevés pour les deux options en fonction de la demande des familles. En l'absence de traitement vétérinaire la productivité de ces animaux fut variable. Les cochons produisirent les revenus bruts les plus élevés mais reçurent les suppléments alimentaires les plus importants. Grâce à ce système agricole les poulets, canards

et moutons donnèrent les mêmes revenus bruts par femelle en âge de reproduction, bien que pour les fermes ou l'efficacité de la reproduction fut élevée et la mortalité des poulets faible, dans ces cas les poulets produisirent une importante part de revenu et apportèrent une large contribution à l'alimentation de la famille. La mortalité due aux maladies fut un problème important pour les volailles alors que les parasites internes furent le facteur limitant pour les cochons et les moutons. Les cochons d'Inde ne présentèrent pas de problèmes majeurs, à part les problèmes de vol, et ils contribuèrent à une part importante de l'alimentation pour les familles immigrantes des hauts plateaux du pays. Les petits animaux ont été complètement ignorés, des systèmes de production et en recherche agricole, en Bolivie et ailleurs. Ils produisent pourtant, pour les pauvres, des revenus et des sources alimentaires significatifs et ceci pourrait être meilleur, juste en améliorant les systèmes d'élevage de ces animaux.

#### **Productividad de pequeñas especies en sistemas de producción ganadera mixta a pequeña escala en la zona subtropical de Bolivia**

**Resumen** – Se estudió durante un año la productividad de pequeñas especies (gallinas, patos, cerdos, ovejas y cobayas) mantenidas frecuentemente en condiciones camperas en explotaciones mixtas de pequeño tamaño en las zonas boscosas subtropicales de Bolivia. Las gallinas y las cobayas eran utilizadas principalmente para el autoconsumo, mientras que los patos y los cerdos eran dedicados principalmente a la venta. Las ovejas eran utilizadas para ambos propósitos, dependiendo de las necesidades de cada familia. En ausencia de tratamiento veterinario, la productividad varió mucho de una granja a otra. Los cerdos proporcionaron los mayores ingresos, aunque también fueron los que recibían más suplemento. En las condiciones estudiadas, las gallinas, los patos y las ovejas proporcionaron ingresos similares por cada hembra reproductora, aunque en aquellos casos en los que la eficiencia reproductiva fue baja y la mortalidad de los pollitos fue baja, las gallinas proporcionaron buenos ingresos y supusieron una contribución importante a la dieta de la familia. La mortalidad causada por enfermedades resultó ser el principal problema en las gallinas, mientras que los parásitos internos fueron el factor limitante en el caso de los cerdos y las ovejas. Las cobayas no tenían ningún problema importante aparte del robo y eran un complemento dietético importante para las familias de inmigrantes procedentes de las zonas altas del país. Las pequeñas especies han sido muy ignoradas en las investigaciones y trabajos de extensión agraria tanto en Bolivia como en otros lugares. Dichas especies suponen una contribución importante a la economía de las personas más desfavorecidas tanto en términos de ingresos como de seguridad alimentaria y esta contribución podría aumentar considerablemente con mejoras simples en el sistema de manejo.