

FACTORS INFLUENCING SMALLHOLDER CATTLE PRODUCTION IN INDONESIA

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Une enquête sanitaire et zootechnique a été entreprise sur 215 troupeaux dans les îles orientales d'Indonésie où la connaissance des contraintes aux productions bovines est mal connue. Pendant trois ans, trois échantillons mensuels ont été réalisés sur des animaux en provenance d'élevages familiaux, et ceci a permis d'améliorer l'évaluation des résultats obtenus par les producteurs. Les méthodes multivariées ont été fort utiles pour interpréter les résultats en dépit des difficultés pratiques de fonctionnement dans la collecte des données, difficultés inhérentes à ce type de travail. Une part des données s'est montrée inutilisable, mais il s'agissait plutôt de résultats de laboratoire (du fait d'une faible répétabilité des tests) que de résultats de terrain. Ces dernières ont été analysées sans difficultés majeures et ont procuré d'intéressants éclairages. La fertilité bovine était basse et la mortalité des jeunes élevée. Les problèmes d'apports alimentaires et de parasitismes de types divers furent dominants et responsables des principales contraintes à l'élevage. Il a été ainsi clairement établi l'intérêt d'une stratégie pour proposer un programme de prévention à faible coût qui devrait diminuer la sévérité de ces problèmes.

INTRODUCTION

The delivery of cost-effective, integrated veterinary services to village farmers requires an understanding of the major constraints to animal production in the area to be serviced. Once the constraints have been identified, specific targeted advice can be provided to smallholders through extension services. Specific sets of a minimal number of parameters should be defined to allow on-going monitoring system of animal health and production in these areas. Health and productivity profiles, which are a specific type of longitudinal study, can be used to provide the required information.

As part of a technical cooperation agreement between the governments of Indonesia and Australia, the Eastern Islands Veterinary Services Project conducted a longitudinal study on five islands of Nusa Tenggara (Eastern Islands) in Indonesia, which stretch across the eastern part of the country above Australia. This area is characterised by low rainfall, and mostly by semi-intensively managed smallholder farming as well as some areas of extensive rangeland. The semi-intensively managed locations included in the study had participated in a rural credit scheme financed by the Nusa Tenggara Agricultural Support project where selected farmers with little or no experience in cattle rearing received one cow and were required to pay back two calves to the project, before getting ownership of the cattle. The objective of the study was to identify factors limiting cattle production under these circumstances, and to identify methods by which these limitations could be overcome. As an additional component of this work, a study was carried out on the data collection process to formulate operating procedures and a set of parameters, which could realistically be used in a national disease information system for continuous monitoring of the efficiency of cattle health and productivity.

MATERIALS AND METHODS

A cattle health and productivity profile study was conducted between 1991 and 1993 in the Nusa Tenggara islands, Indonesia. The islands can be divided into two administrative groups, the western group called Nusa Tenggara Barat (NTB) and the eastern called Nusa Tenggara Timur (NTT). At 10 sites with semi-intensive and 3 sites with extensive rangeland cattle production, 215 smallholder farms with 750 cattle were visited every 3 months for examination and sampling of designated animals, resulting in up to 12 repeated samplings per animal. At each visit farmers were also interviewed using a questionnaire about general village, farmer, livestock management and farm production data.

The data was first analysed descriptively to develop a general understanding of the underlying production system and identify data entry errors. In the univariate analysis relationships between production parameters and potential risk factors were investigated. Given the availability of time-to-event data such as calving intervals or time-to-death, survival analysis techniques were used to analyse the effect of risk factors such as breed or various management parameters. The multivariate analysis was conducted with the aim of describing the multifactorial relationships within the production system using path modelling with respect to a set of production outcome variables such as calving probability. The statistical methods Cox's proportional hazards regression analysis, logistic regression and least squares regression were used in these analyses.

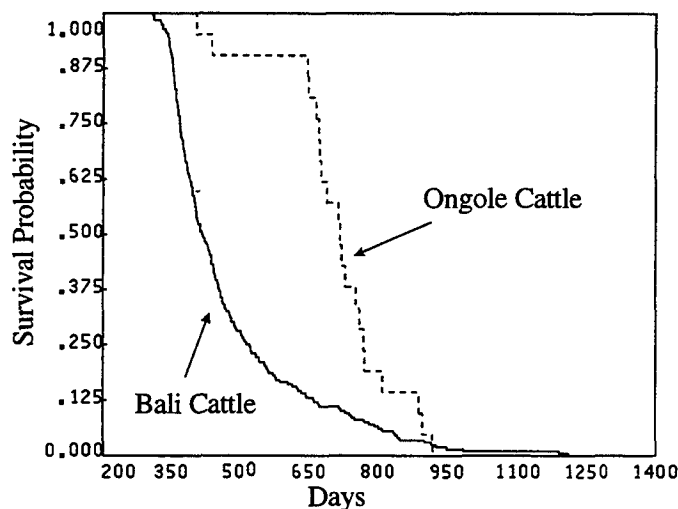
RESULTS

The descriptive analysis revealed that of the 214 cattle owners interviewed, 21.5% were younger than 30 years of age and 15% older than 50. About 25% of farmers had no education and 60% had attended primary school. All farmers in NTB were Muslims and 99% of farmers in NTT belonged to the Christian religion. About 44% of

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households consisted of 5 to 7 persons including children, only 20% had more persons. Fifty percent of farmer families had between 1 and 3 children. Only 30% of farmers included in the study had more than 5 years experience in cattle rearing. Seventy-eight percent of farmers had obtained their cattle through the rural credit scheme. The most common sources of information about cattle rearing were other villagers (41%) or parents (12%). Average landholding size was very small. Most farmers owned an area around the house for growing fruit and vegetables (average of 0.3 ha), an area used for crops (average of 0.9 ha) and an area used for rice growing (average 1.1 ha). In terms of cattle management practices, most farmers tied up their cattle during the day, where necessary with cut feed, and stabled them at night. In the locations with rangeland conditions cattle were herded continuously or left to graze freely during the day. Feeding was mainly through natural grazing supplemented by hand-gathered food provided in the stable. Most farmers (> 70%) used cattle manure as fertilizer on their own fields. The majority of breeding was through natural service. Eighty percent of farmers indicated that they detected oestrus in their cows through observation. Only in NTB cattle were used commonly for draught power. The average number of cattle varied between 2 and 4 head. Most farmers also kept some goats and chickens. Only in NTT, farmers kept also pigs. A mortality rate of 6.8% in cattle was observed during this study. In calves 40% did not survive beyond the age of 3 months. Average age at first calving was 3.6 years in NTB and 4.1 years in NTT. Calving rate was calculated as 60% for NTB and 40% for NTT (figure 1) presents the survival curves for calving intervals by breed.

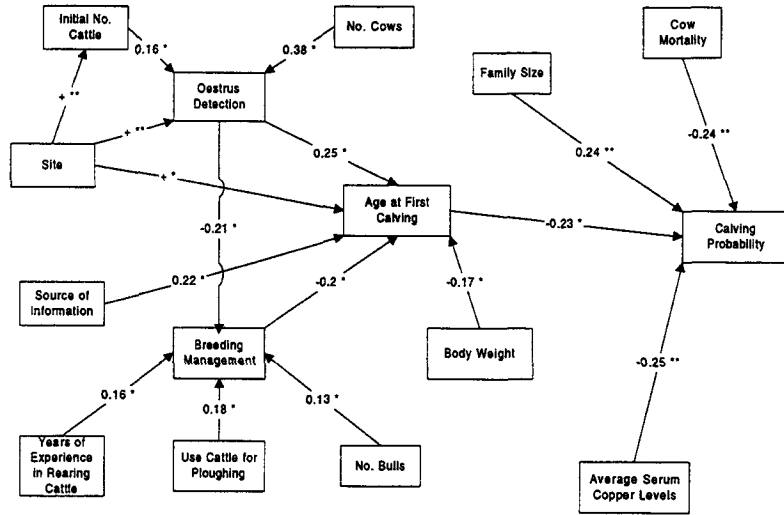
Figure 1
Survival plots of time between successive calvings in cattle stratified by breed



In the multivariate analysis of the time to event data, it was found that time to death was statistically significantly associated with the sex of animal (hazard ratio males versus female: 2.078, $p=0.0003$), location and vaccination status for haemorrhagic septicemia (hazard ratio vaccinated against non-vaccinated: 0.2, $p=0.0000$). Calving intervals were longer if an abortion had been recorded (hazard ratio 0.62, $p=0.0085$), if the animal was of the Ongole breed (hazard ratio 0.41, $p=0.0006$), if body condition was worse (hazard ratio 1.4, $p=0.0072$) and if the cow was serologically positive for *L. tarassovi* (hazard ratio 0.64, $p=0.015$).

Separate path models were constructed for weight gain, calving rate and income from cattle. The model for weight gain indicates that *Fasciola* infestation and increasing age resulted in reduced weight gain, whereas increased PCV levels, male sex status, average rainfall, body weight, paramphistome infestation, blood phosphorus levels, a late rainy season and early dry season were associated with increased weight gain. The model included indirect effects of age and breed. In the path model for calving probability, reduced cow mortality, increased family size, reduced age at first calving and reduced copper levels related to an increased calving rate. In this path model, the parameter age at first calving represented the indirect effects of oestrus detection method, breeding management, years of experience in rearing cattle, herd size as well as location (see figure 2). The final path model for income from cattle included direct effects of location, type of production system as well as size of the herd. Herd size in turn was mainly influenced by calving rate and calf mortality.

Figure 2
Final path model for calving probability in cows for CHAPS farms (statistical significance of regression coefficients indicated as * < 0.1 and ** < 0.05)



DISCUSSION

The results of the analysis suggest that cow fertility and calf mortality are major constraints in this production system. Low body weight related to low feed quality, quantity and availability as well as Fasciola infestation and poor breeding management were identified as being causally related to poor cow fertility. Ascarid infestation was thought to be the major cause of calf mortality. Farmer's income from cattle was directly influenced by herd size and calving probability. Infectious disease data could not be included in the analyses because the serological test results were inconsistent.

The conclusions from this analysis is being used to devise a targeted animal health care programme, to specifically address cow fertility and calf mortality through management recommendations and treatment.