

variations of forage resources lead to a natural season of calving from December to March, when savannahs are green and the grass is of good quality. The mating season extends from mid-February to June, with several males in the herd. According to the breeders, the Moka cows have good reproductive capacity and great longevity: they produce one calf per year, on average, along a productive life which can last 15 years. Calving is easy, without supervision or intervention. Marketing is done mostly by direct sale of live or slaughtered animals. Three-hundred twenty-five animals were listed on the survey, on 11 farms, with an average of 30 animals per herd.

Thirty-three animals typed as Moka by their owners were the subject of a phenotypical description and measurements. The mean value for the thoracic perimeter, the height at withers and the rump width are respectively  $162 \pm 15.2$  cm,  $116 \pm 8.3$  cm and  $120 \pm 17.6$  cm; the mean liveweight of males and females are  $430 \pm 85$  kg and  $340 \pm 45$  kg respectively. These results constitute the initial values of a zootechnical description of the breed. They show the underaverage development of the animals, which can be qualified as medium sized. A photographic database of individual animals was created and could be used for the definition of the standard of the breed.

The genetic analysis showed that the population presents a good allelic richness (6.7 alleles/locus) and genetic diversity (measured by an unbiased heterozygosity of 0.75), and a low estimated consanguinity (3.3%). Some specific features have been identified, such as the presence of zebu specific alleles, but few admixtures of taurine cattle. The relationship of this breed with African breeds, especially from Madagascar, or with European or Creole cattle will be studied in more detail in the future.

### Conclusion

This first approach provided initial results on breeding systems and the Moka cattle population to build a file of national recognition. It also put forward the many constraints with which breeders are confronted, such as land constraints and transmission problems. Beyond the difficulties of organization of these breeding activities, which are not part of official programmes, it seems to us that the present breeding model will not be able to continue because of the disappearance of savanna following rapid urbanization. So, the question is the following, is conservation of this breed anyway compatible with a less pastoral breeding model? However, this breed shows some original characteristics that make it a valuable genetic resource for tropical environments. The presence of a selection signature for adaptation to tropical constraints that could be present in this breed will be investigated.

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## Intensive production system of collared peccary (*Pecari tajacu*) in Brazilian Amazon

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### Introduction

Wild game meat is one of the most important feed resources to rural communities that live in the tropical forest, however, in Brazil hunting is an illegal activity. Strategies are required to establish policies addressed to this type of activity. They must be based on adopting sustainable management programs and include elements to conserve target species of illegal trade and ensure legal means of access to a large portion of the Amazonian population, who have strong cultural ties with these resources. The collared peccary (*Pecari tajacu*) is one of the most appreciated game meats in the Brazilian Amazon. The general purpose of our work was to study the captive production system of collared peccary to obtain a viable production for subsistence or commercialization. This study describes the main results of a captive management program on collared peccary in the state of Pará, Brazil.

### Material and methods

The behavioural, reproductive, sanitary and nutritional aspects of collared peccary were studied in the last 10 years (between 1999 and 2009) on an experimental farm of collared peccary in Embrapa (Belém, Pará, Brazil, 01° 24'S; 48° 20'W). The climate of this region is equatorial with an average annual temperature of 27°C, and an average relative humidity of 80%. All reproductive groups were formed by a 1:3 male to female rate ratio, individually raised in paddocks of 21 m<sup>2</sup>, 36 m<sup>2</sup> and a single large floor paddock of 450 m<sup>2</sup>. All animals were maintained under natural lighting conditions. Paddock temperatures ranged from 22° to 32°C. The caloric and protein supply per animal and per day were 2500 kcal and 14%, respectively. Water was always available.

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## Results

The animals are clearly diurnal, being especially active in two periods: from 6:30 to 10:30 a.m. and from 2:30 to 4:30 p.m. The individuals generally interact with all their congeners, independently of their sex and age. Interactive acts were mainly amicable (88%). When becoming older, males engaged in more sexual interactions, preferentially with old females. Older sows were more aggressive than younger ones. Dominance relations were evidenced in all groups, based on the frequencies of agonistic and submissive behavior, but no linear hierarchy was detected. The reproductive analysis results show that parturitions were distributed throughout the year. The mean age at first parturition was 639, although, the earliest first parturition occurred at 381 days of age. The mean duration of gestation was 138 days. Based on the presence of mating the first post-partum oestrus was observed at 8 days. The average litter size was 2 newborns per parturition (sex ratio of 52.6% females and 47.4% males), with newborn deaths occurring in the first two days of life. The seminal features observed were the following: volume  $0.81 \pm 0.86$  mL, concentration  $137.44 \pm 153 \times 10^6$  spz/mL, pH  $7.92 \pm 0.73$ , motility  $52.66 \pm 28.79\%$ , vigor  $2.2 \pm 0.8$ , viability  $55.84 \pm 28.55\%$  and total abnormalities  $31.52 \pm 13.81\%$ . There were no significant changes in production and semen quality along the months of the year. The results from serology for different infectious diseases showed that collared peccaries had antibodies against *Brucella* spp. (4.9%) and to *Leptospira* spp. (9.8%). None of the sampled captive collared peccaries showed antibodies against pseudorabies, porcine influenza virus, foot-and-mouth disease, porcine circovirus type 2, porcine parvovirus, porcine respiratory and reproductive syndrome, salmonellosis, swine erysipelas or tuberculosis. The results for endoparasites showed 71% *Toxascaris* sp., 46% and less than 10% of *Entamoeba coli*. The *Entamoeba histolytica*, *Balantidium coli*, *Endolimax nana*, *Oxiurus* sp. e *Strongyloides* sp. occurred at multiple infections and *Balantidium coli*, *Ascaris suum* e *Strongyloides* sp. were found with less incidence. In relation to nutritional characteristics, one alternative ration substituting an amount of corn by babassu meal (*Orbignya phalerata*) was tested. The best results of weight gain and consumption were with the diet with 40% of babassu meal, and because it costs less than corn, it results in one significant economy for production system costs. The carcass parameters studied were the dressing percentage, commercial cuts, corporal composition, carcass measurements, organs and glands. The dressing percentage was very good, with 52.64 a 58.84%. The meat was soft, succulent and thin resulting with the analysis of the shear force, cooking losses, pH and water holding capacity and the meat also had a high proportion of unsaturated fatty acids (more healthy).

## Conclusions

In conclusion, the results confirm that collared peccary is a viable species for intensive production system in the neotropics, once this species presents satisfactory reproductive parameters. Also, the behavioral characteristics of captive collared peccaries seem favorable to its successful commercial breeding. These are important factors for good breeding system management practices of this species, since the commerce of peccary products is very important in Latin America and the Caribbean.

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# Mixed crop livestock systems in the developing world: present and future

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## Introduction

The world is under significant pressure. The human population is projected to increase by 30% over the next quarter of a century to reach 8.3 billion by 2030 (UNPP, 2008). During this period, in developing countries, there is likely to be a rapid increase in demand for livestock products, driven by increasing urbanisation and rising incomes (Delgado et al., 1999). At the same time, the impacts of a range of driving forces such as water availability, climate change, and technological innovations on smallholder crop and livestock production may be substantial. The result of these drivers is that the farming systems responsible for global food security will inevitably change. The challenge is to ensure that the resource-poor, mixed crop-livestock, smallholder sector, which currently provides the majority of milk and meat in the tropics, is able to take advantage of the opportunity to meet the increased demand for these products. To do so the sector will need to

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