

# Minilivestock in Argentina. Integration with Agricultural Production

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## Summary

*The development of alternative agricultural production can take different forms. In Argentina there is an important diversity of species available to be incorporated into production systems, giving support for the use of natural resources based on taking advantage of the regional fauna. Moreover the use of different animal species can be incorporated under the concept of the optimization of flows of energy and materials, tending to minimize the environmental impact of livestock production, and also to make more efficient use of the ingredients required for developing the activity. The integration of non-traditional species (minilivestock) within the context of sustainable agricultural development was the motivation for the present study. A module for raising *Myocastor coypus* (coypu or false nutria) was developed, to which was linked a module for raising *Eisenia foetida* (the so-called red worm), in both cases with a dual purpose. Preliminary estimates were made of the productive aspects of both species, as well as an analysis of their integration, to understand the extent to which diversification linked with complementation tends to optimize the system.*

## Resumen

### **Especies no tradicionales en Argentina. Su integración a la producción agrícola.**

*El desarrollo de alternativas de producción agropecuaria puede tener distintas formas de abordaje. En Argentina se dispone de una importante diversidad de especies susceptibles de ser incorporadas a los sistemas productivos, dando impulso al uso de los recursos naturales basado en el aprovechamiento de la fauna regional. Además de la utilización de las distintas especies animales puede incorporarse el concepto de optimización de los flujos energéticos y materiales, tendiendo a minimizar el impacto ambiental de las producciones pecuarias y a aumentar la eficiencia en el uso de los insumos requeridos para el desarrollo de las actividades productivas. Con el objetivo de integrar especies no tradicionales a la producción agropecuaria dentro del marco conceptual del desarrollo agropecuario sustentable, se implementó un módulo de cría de *Myocastor coypus* (falsa nutria o coypu), al que se integró un segundo módulo para la cría de *Eisenia foetida* (lombriz roja), ambos con doble propósito. Se presentan y discuten algunas evaluaciones preliminares referidas a aspectos productivos de ambas especies.*

## Introduction

Argentina is the most southern country of South America. It shows a wide variety of bioclimatic conditions ranging from the subtropical forests in the North of the country with poorly defined seasons and average precipitation of 2000 mm to the Patagonia, a tableland region constituting the Southern tip of the country with a cold and windy climate and a rainfall less than 200 mm a year. Santa Fe state is located in the Central East of the country, in the middle of the vast and humid grassy plain known as *Pampas*, with a temperate climate and annual average precipitation of 1200 mm. The Faculty of Veterinary Sciences, where this investigation was carried out, is located in Casilda City, in the South of the state, at 60 km from the Paraná River. This river is also the natural habitat of wild coypu (*Myocastor coypus*), a rodent which reaches an average adult weight of 6-7 kg and is found in family groups of one male with several females. The females have on an average 4 to 5 young per litter with up to 2 litters per year.

The captive breeding of *M. coypus* dates back to the beginning of this century in our country and from the 1930s in other parts of the world like Poland, Russia and the United Kingdom among others. This species has originated from our temperate climatic zone and has an aquatic habitat associated with rivers, creeks, and lagoons of the moist Pampas and the subtropics (9). Originally the production of this rodent was mainly to obtain fur, and this tendency continued and increased for several decades because of a strong global demand. Countries of Eastern Europe and the former USSR were active in the development and exploitation of this rodent. In recent years, however, with growing pressure from environmental groups against the use of animals for fur, and with market fluctuations depending on fashion trends, the market for furs and especially for coypu fur, has declined markedly and for this reason economic activity has diminished to levels that were difficult to afford. The market is growing again now, and

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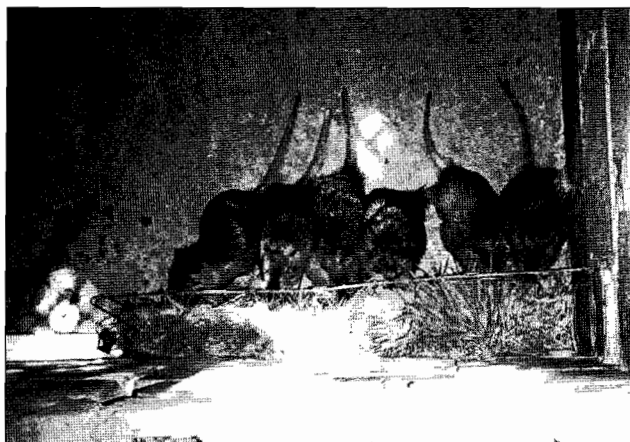
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**Photo 1** - *Myocastor coypus*. Variety obtained by breeders of a cooperative in Cordoba Province Argentina. Coypu variety "cagimo"



**Photo 2** - *Myocastor coypus*. At the research unit of the Veterinary Faculty - National University of Rosario. Wild variety.

in our case the CEAV (Centro de Estudios Ambientales de Veterinaria) has incorporated a new integrated farming of this rodent, especially with the potential of obtaining an animal with the dual purpose of meat and fur (14,15,17). The meat of this rodent is of very good quality and is well accepted by the people of various parts of the country (especially meat from farms).

Although the red earthworm (*Eisenia foetida*) is not a native to our country, it has been introduced to Argentina and is easily found in sites with abundant decomposing organic matter. This annelid is from the Eurasian family Lumbricidae but its actual distribution is very wide and generally cosmopolitan (12). This earthworm lives in the superficial layer, and unlike many other common earthworms, does not form galleries in deep soil; according to the ecological classification of earthworms (3) it is a member of the group of epigeic forms. It does not exceed 6-7 cm in length but, although small, its capacity to survive and to transform organic matter, combined with its abilities for rapid growth and multiplication, make it a species particularly suited for the needs of agricultural production. It is also the most widely used species of annelid for earthworm production worldwide, an activity which is in full expansion in our region.

The rodent and the annelid species mentioned above were integrated in an experimental module to evaluate,

among other factors, the relative abundance of each other for an adequate and complementary farming functioning. These studies set conditions for the design of integrated production systems, which can be easily adopted by the local producers. They also bring information which may be extrapolated to other species by calculating the amount of manure produced and the amount of earthworms necessary for its processing. As this approach must be designed within the bounds of economic reality and the ability to put it into practice, commercial tests were made at the local level to estimate the potential demand for meat and fur from the coypus and for humus produced by the worms. These studies take also into account the feasibility of future sales of live worms for the establishment of new modules, or as a protein source for commercial diets. The integration was made under the conceptual framework of sustainable agricultural development, working towards the implementation of systems sustainable in time from economic and environmental points of view. The very idea of using a valueless waste product (coypu manure) as the basic input for a productive activity (worms) is at the least an interesting approach to the theme. The operative focus used is based in concepts of Agroecology, understood as the science that unites understanding of ecosystems based in applied ecology with agricultural production (1).



**Photo 3** - Earthworms. *Eisenia foetida*.



**Photo 4** - A bed of earthworms at the research unit. Veterinary Faculty N.U.R. - The waste of coypus is processed and transformed in humus.

## Materials and methods

### COYPU

Two varieties, standard or wildtype from the local area, and Cognac, obtained from a producers' cooperative in Miramar, Province of Cordoba, Argentina, were used in this study. The installations have a total area of 50 m<sup>2</sup> consisting of 11 corrals with constructed roofs and cement floors. The animals were arranged in families of one male and 4 or 5 females. All animals were marked at birth and were weighed every two weeks to follow their food conversion efficiency and growth (14,15,17). They received no routine medication or vaccines. They were fed once per day with a cereal based diet (50% corn) with 16-17% crude protein and 7% fiber. This diet was supplemented with other products available at different times of the year (sunflower and soya byproducts, opting for the most economical) without varying the quality of the feed. The animals had access to running tap water provided through automatic drinkers. The total population of the unit was between 45 and 70 animals depending on the point in the harvest cycle.

### EARTHWORMS

*E. foetida* has been recorded in many zones and on many occasions (10,13) in Argentina, but never before in the Caseros Department of the Province of Santa Fe. Thus the first step was to explore possible environments in this zone where *E. foetida* could be found. During field studies in 1992 wild samples of this species were found at three sites not far from each other, each sharing the characteristics of having quantities of decomposing organic matter (2). Samples were sent to the Universidad Nacional de La Plata, Facultad de Ciencias Naturales y Museo where they were identified as *Eisenia foetida*.

The above mentioned process was adopted a) to confirm the presence of *E. foetida* in the Caseros Department, b) to start a small scale colony with individuals not from commercial sources, and c) to undertake both biological and productive (vermiculture) evaluations which allows comparisons with data available from populations that has been introduced for commercial use.

A breeding colony of 8000 worms was formed under captive conditions with different types of food with manure of various domestic species (cow, horse, coypu, rabbit). This first stage allowed development of management techniques, including some recommended by the literature (6,7) as well as some alternatives developed by this Center. These new management techniques developed by our research group are based on periodic feeding of the worm beds without pre-maturation of the manure. Once the worms were adapted to the new captive conditions, the worm beds were conditioned with a density of about 100,000 individuals per m<sup>3</sup> of substrate in order to process in a controlled manner the manure from the coypu corrals (4). To start there were two beds of 1 m by 2 m each by 0,25 m deep with coypu manure previously aged for four months for subsequent trials. Once the population was established worms were fed by the periodic lateral incorporation of fresh (without aging) manure every 7 to 15 days depending on the time of year. Manure was offe-

red in layers approximately 10 cm deep. When the substrate is depleted, the worms colonize the food, allowing the harvest of the humus they have abandoned (continuous system). Later the direction of feeding is inverted, with manure deposited on the opposite side, allowing a cyclical system. Humidity was maintained between 70 and 80% using artificial irrigation when precipitation was insufficient.

### Implementation of the module (integration phase)

The implementation of the integrated module (see Figure 1) was in the field, with conventional installations for the coypu (described above) and with the worms on the ground under open sky with a covering of plastic mesh (1 mm mesh size) and protected by a perimeter wire fence to impede access to predators. The manure produced by the coypus together with food remains and the bales used as bedding were accumulated in an area designated for storage, from which provision to each worm bed was controlled. The beds were watered weekly with tap water and periodically with water used to wash the coypu pens, which was collected and stored. Humus was collected periodically every 2 to 4 months depending on the time of the year and was kept in a storage area from which it was removed to be sifted and packaged in polypropylene bags of various sizes, according to its destination, for later commercialization.

### Results

**Coypu:** The subsystem functions with a group of 12 to 15 reproductive females, 60% Standard and 40% Cognac. Females reach reproductive state at approximately 6 months with an average weight of 3.5 kg, while males are reproductive at an age of 7 or 8 months at a weight of about 4.5 kg. The gestation period lasts 129-132 days with an average of 4 or 5 animals per litter, allowing two litters per year. The young are born with a weight of 180-240 g and are weaned at 45 days with a weight of 800-1000 g. Slaughter is at 6-8 months (mean weight 4.5 kg). The total production is about 50 to 60 young per year, with 20% used to replenish the breeders and the rest for slaughter (yield of 2.5 to 3 kg of meat per animal at 6 months of age).

**Worms:** Based on the observed rates of population growth and individual growth for the conditions in this zone (16), the implementation of this production at the

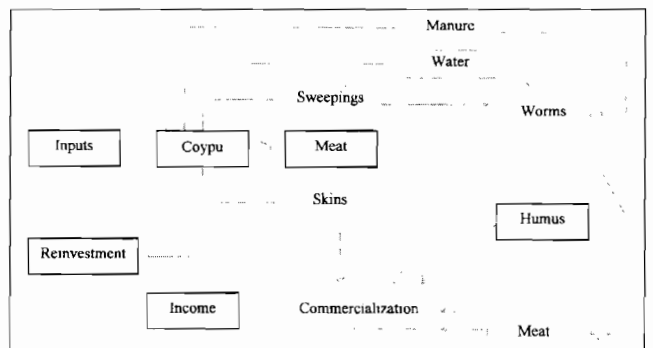


Figure 1 - Flows diagram in the integrated module

scale proposed represents the possibility of obtaining a yield of 875 kg of humus per year. On this basis the proposed module represents an expected growth of at least 6 to 1 per year, which allows sending humus and excess worms to the commercial circuit. However at this scale it would be recommendable to recycle this excedent within a wider production cycle with the incorporation of other variants such as gardens, chickens, pigs, etc., to optimize the system.

**Integrated module:** The integration was analyzed using the following proportions: 50 coypus, 1,460 kg of sweepings and worm beds of 1 m<sup>3</sup> with approximately 100,000 individuals each.

This model can be transferred to other species based on the estimation of the average quantity of manure produced per animal per day. Using coypu, the calculated quantity is approximately 55 g per animal per day, combined with wash water, which in turn has a certain quantity of bedding and lost food (0.851 g per day). All this produces a total of 4 kg of organic matter per day, which combined with 30% water can be processed by 10,000 worms in one bed of 1 m by 2 m each with an average density of 100,000 individuals per 1 m<sup>3</sup>, which in turn produces 875 kg of humus per year (16).

## Discussion

The system described allows speculation about the integration of species to optimize the use of available resources, at small and medium scales, and above all when it is time to consider the incorporation of alternative species to traditional production (of larger scale),

not substitutive but rather complementary.

The adoption of criteria to substitute unidirectional flows with closed cycles might be a superior alternative for the use of living resources.

The extension to other uses by way of the incorporation of other species, integrating further links or a cycle of inputs could be done with an infinite number of variants, and each of these should include some type of decomposer which in this case is *E. foetida*. Obviously the incorporation of primary producers, although not tried in this study, would reduce the economic cost and perhaps environmental impact of the proposal.

The incorporation of intensive production systems brings with it an increase in the number of animals per unit area, with the consequent increase in production of wastes (food remains, manure, used water, etc.). This situation increases the environmental impact and lost resources. Vermiculture has been shown to be an efficient tool for solving such problems, closing some cycles, avoiding the elimination of wastes, returning and maintaining soil fertility, and reducing the use of chemical fertilizers (5).

In agreement with the other authors (11,15), the most important ecosystemic value is the maintenance of the diversity. The incorporation of non-traditional species (minilivestock) into the traditional production system would contribute to the diversification of agricultural production.

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