BUFFALO MILK AND MEAT PRODUCTION SYSTEMS ON A SMALL FARM IN AMAZON

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ABSTRACT

Was described a module to buffalo milk and meat production, associated to forestry, with the objective of integrating the small propriety in Amazon to the productive system, with social, economical, ecological and biological effects. Are shown production costs and the revenue of the commercialization of animals and milk.

Key words: buffalo cow, meat production, milk production, murrah race, small propriety

STATE OF ART

On the tropical and subtropical areas, 30° N and 30° S latitude, are found the bigger part of bovine, buffaloes, caprine and ovine herds. On these area, inconsistent animal breeding, nutritional problems, diseases, parasites and the reduced technological resources, cause serious prejudices to animal production. In Brazil, milk consumption " per capita" is of 270g/day, while the Health World Organization recommends 400g/day and the animal protein of 200g/day, half consumed on developed countries, mainly due to environmental effects on meat and milk production.

The history of the domestic buffalo (*Bubalus bubalis*) has its origin in Africa. This specie was taken to Africa, latter to Europe and recently to America. In Brazil, its arrival occurred in 1895, with animals of the Mediterranean races, that came from Italy, brought to Marajo island by the farmer Vicente Chermont de Miranda. From there on, several importations of bunches of buffaloes were mode to different brazilian regions. Buffalo plays a very important role on Asia's agriculture, as milk, meat and work source. On the Latin-American countries, mainly in Brazil, its contribution on its aspect will can be of great importance to small and medium farms. On the last years, buffaloes have been an important alternative source of food production to supply the needs of developing countries (17), because they better utilize the forages of low nutritions value , in areas of difficult utilization by others species on by agriculture. (16).

The buffaloes world herd is estimated in 164 millions of heads. Its vegetative growing was approximately 53% on the last three decades of the past century, against only 21,5% of the effective bovine. Asia holds the biggest herd of the world, with 143 millions of heads, being that only India has 90 millions, China 30 millions and Paquistan 10 millions. In Europe, the herds of Italy, Rumania, Bulgaria and Yugoslavia points out. (6, 7, 8). According to the estimatives, the buffalo national herd gets up to 3,5 millions of heads. It is important to mention that the state of Para has around 1,5 million of heads distributed, basically, on Marajo island and in the low and medium Amazonas. The annual growing is superior to 10%, more than five times the one of bovine in Brazil, although estimatives exists that this rate is around 6%. Therefore, according to IBGE (1, 2), the buffaloes population of Brazil is around 1,6 million of animals, of which around 1 million is found on this region, mainly on Marajo island and in the " varzeas" of the Amazon River.

Buffaloes found in Amazon its ideal habitat, with the privilege of sheltering the three subspecies existent in Brazil (*Bubalis, Kerebau* and *Fulvus*), grouping animals of the Mediterranean, Murrah,

Jaffarabadi and Carabao races, bends the Baio Type. They are excellent meat, milk and work sources, and considered as ecological animals, producing and reproducing on bad and useless flooded native pasture lands, where bovines can barely survive. (13, 14).

In Amazon, the mains purpose of buffalo farming is meat production, which is mode in two farming system. The first extensive, on the traditional areas of farming, utilizes the ecosystem of highland and "varzea" native pastures, distributed on Marajo island, and on the bounders of the Amazon River and in Amapa and Roraima States. The other system, in minor proportion, is located in areas of better development, where the forest was taken over by cultivated pastures, which herd is mode of animal of better genetic pattern.

Beginning from the seventies were obtained the first results of research on buffalo meat and milk performance, through the Embrapa Eastern Amazon, in Belem, Para State, that belongs to the Brazilian Agricultural Research Organization - Embrapa. Although buffalo farming is a viable alternative to make possible the use of difficult utilization by others species and by agriculture, the available technologies still are few applied to increase the productivity of the animals.

Embrapa Eastern Amazon has the biggest heap of know lodgment on buffaloes for meat and milk production on the american continent, that indicates these animals as better ecological option to occupy the huge pastures areas of Amazon region, producing and reproducing in an exceptional manner, with on damage to the environment and with positive effects on the local socioeconomy.

MILK PRODUCTION

One of the more important buffalo functions is, undoubtedly, milk production. This is, most of the time, the objective searched, moreover, in some Asiatic countries where religion does not allow meat consumption. For example, in India, although buffaloes herd is only about 24% of the total bovine and buffaloes herd, around 65% of the milk produced in this country comes from buffalo cow. It is important to point out that in India milk consumption " per capita" is twice bigger than in Brazil and its population six times bigger (12, 15).

Buffalo milk production is one activity of great importance in several countries of the world. In Brazil, although buffaloes are raised for meat production, milking activities have had excellent results, being considered an alternative to improve the socioeconomy of the agricultural sector, through the processing and commercialization of its derivates (3, 13).

Buffaloes have exceptional long lasting productivity and can produce milk up to 18 years of age. In Brazil, are considered excellent milking buffaloes the ones that produce more than 7 liters per day. It is important to mention that the buffalo cow called "Limeira", that belonged to Embrapa Eastern Amazon produced 4,645 liters in 365 days, producing 20 liters/day on the top of the lactation. The use of selection programs and of management techniques have moved forward milking productivity and the production of 3,000 liters/cow/lactation, considered a record three decades ago was supplanted by cows that produce 4,000 to 6,000 liters/ lactation of 300 days (8, 13).

The Para State is one of Brazil's biggest powdered milk importers. The "per capita" consumption is only of 60g/ day, while the Health World Organization, recommends 400g/day. The commercial exploration of buffalo milk was initiated on the decade of the eighties and today in São Paulo, Ceara, Maranhão, Bahia, Parana, Santa Catarina and Para States, Brazil, there are dairy industries the process buffalo milk exclusively. The high quality of buffalo milk has been recognized on the commercialization of this product in some countries. In India, for example, its price on the market reaches value 40% to 50% superior to the bovine milk.

In Embrapa Eastern Amazon was observed the buffalo milk of the Mediterranean race, in relationship to the milk of zebu of the Sindi race, has higher levels of dry matter, fat, not fatty solids, casein, fixed mineral residue, calcium and phosphorus, being practically equal in lactose. On the other hand, is slightly more dense and its lesser dornic acidity may signify less quantity of microorganisms. Mediterranean, ½ Murrah, ½ Mediterranean and ¾ Murrah, ¾ Mediterranean buffaloes of Embrapa Eastern Amazon, raised a pasture system, in Belem, Para State, Brazil produced 2,055 kg; 2,062 kg and 1,958 kg, respectively.

PRODUCTION TECHNOLOGY FOR MILK DERIVATES

The technology generated by Embrapa Eastern Amazon, for buffalo milk processing, makes possible better profits to buffaloes farmers, mainly to the ones that do not sell their products "in nature" to the big urban centers. Among the products developed points out the process to make cheese "CPATU white soft", which rate is of 5,5 liters of milk/ kg of cheese, and provolone cheese, that needs 7,45 liters of milk/kg of cheese. These results points its high economical importance, since are needed from 6 to 10 liters of bovine cow milk to make 1 kg of these cheeses. The Embrapa Eastern Amazon also generated excellent technology for the making of natural yogurts with flavor of regional fruits. The yogurt mode of bovine milk normally needs the addition of substances to make thick the mixture, giving it better viscosity, texture, appearance and a more creamy fence product. The yogurt mode of buffalo milk does not need the addition of these substances.

Buffalo milk presents industrial profit on dairy industry 40% superior to the bovine cow milk. The milk still has 33% less cholesterol, 48% more protein, 59% calcium and 47% phosphorus. Because it has higher fat content, are necessary only fourteen liters of buffalo milk to produce one kg of butter, while using bovine milk, its necessary more than twenty liters. On the other hand, with only five liters of buffalo milk one can make one kg of mozzarella cheese of high quality (4, 13, 15). This superiority, in terms of chemical composition, also was found when results of research showed that buffalo which has, related to the bovine milk, 43.81 % total solids, 43.60% fat, 17.10% unfattened day extract, 41.54% protein (casein), 2.4% lactose, 15.30% fixed mineral residue, 42.10% calcium and 42.86% phosphorus (5, 9, 10, 11). One outstanding characteristic of buffalo milk is its white color, due to the presence of vitamin A and absence of carotene pigments, percussion of this vitamin. This, butter and cheese is that, despite of not having to much more lactose than the bovine milk, its flavor is sweeter (10).

The most traditional derivative, originally from Italy, produced exclusively with buffalo milk is the mozzarella, one kind of filet mass fresh cheese, with unequal flavor, smell and texture, shaped on differents forms such as balls, knots, pig tails or bars, pashed in serum or not, consumed as entrée, appetizers or part of diverse plates (8). Its is regrettable that countries such as Brazil, do not export buffalo milk derivatives since Italy exports mozzarella or refrigerated planes to countries like USA and Canadian, at US$ 12.00/kg (18).

MEAT PRODUCTION

In our country, buffaloes have showed meat production performance only satisfactory, weighing around 350 kg, in between 2 and 2 ½ years of age, while bovines gets to this weight only when three to four years old. However research, date on buffalo meat production fattened in cultivated pasture, in different places of Amazon region, shows daily weight gain averaging from 0.372 to 0.686 kg. Utilizing supplementary feeding the animals fatten in average 0.805 kg/day. On Marajo island, with supplementary feeding, the daily average gain of weight were from 0.730 to 0.741 kg for male and from 0.832 to 0.862 kg for females.

Buffaloes show high potential for meat production, what could be evidenced using the available technologies. Researches have shown that, in cultivated pasture, using intensive rotationed grazing system, buffaloes reach alive weight superior to 500 kg, when younger than two years old. On integrated system of native pasture of "varzea" and cultivated highland buffaloes shows alive weight superior to 450 kg, when two years old. On native pasture of low nutritions value buffaloes have a performance yet considered satisfactory, reaching around 400 kg when 2 ½ years old.

PRODUCTION TECHNOLOGY FOR MEAT DERIVATES

Research results of buffaloes and bovine meat analysis, realized in 1991 by the United States Department of Agriculture (USDA) in 100 g of baked meat, revealed that the buffalo meat has 40% less cholesterol, 12 times less fat, 55% less calories, 11% less protein and 10% more minerals, this being more indicated for human health.

Buffalo meat characterizes by its dark-red color, interlaied by white fat, that gives to the carcass an attractive and good quality appearance and has fibers stickers than the bovine meat. It is similar to

the bovine meat on its basic structural properties, chemical composition and flavor. The fat deposition pattern is slightly different from the bovine, with less accumulation of fat between muscles and inside of them, what results in less marbling.

According to the age, variations occurs on the fat percentage of the carcass buffaloes kept under same conditions, when 18 months olds, have 4.8% of fat, what gives value to the meat cuts, while that when at the 24 months, this rate goes to 19%, allowing to conclude that the animal shall be slaughtered younger, viewing better carcass profit. On tasters test realized on Embrapa Eastern Amazon was found no difference on the tasting of buffaloes and bovine meats, cooked or roasted.

Research on Bulgaria and Romania showed that the chemical components of the buffalo and bovine meat are same, although in variable proportions. The buffalo meat has minor marbling grade, more slim meat, more protein, more pigmentation and less humidity than the bovine. Has 40% less cholesterol, 12 tires less fat, 10% more mineral felts and is 55% less caloric and 11% more protein. By its similarities, and in some cases superiority on nutritional composition to the conventional meats, red (bovine) and white (chicken), it is an important source for derivative production of exceptional quality.

On Para State, there is few studies on physical, physical - chemical, microbiological and sensorial characterization, as also on the formulation viability, elaboration, conservation, and life shelf of the processed products of buffalo meat, such as large Italian sausage, sausage, ham, hamburgers, smoked meat, seeking transfer of technology, what would allow to stimulate the processing industry in Amazon. The Department of Chemical Engineering of the University of Para State started researches on the area of food technology and has the preliminary results on the characterization of derivates products, such as smoked meat.

MEAT AND MILK PRODUCTION ON A SMALL FARM IN AMAZON

Following will be presented a model of a project implanted on area of 25 ha on the Murrah Ranch, on the municipality of Primavera, Para State, Brazil, using a ten ha module of braquiarão (*Brachiaria brizantha*), on the high areas, and star grass (*Cynodon nlemfuensis*), on the humid areas, divided in nine plots of 1,11 ha each, with management of from three to five days occupying, depending upon forage availability, and resting period varying from 30 to 36 days (Figure1). One of these plots will be taken for reserve area, to be used on emergency, such as fire, plague attack and disease, long dryness period, etc. This plot must be managed by others animal categories, to keep the forage in good quality. The pasture was fertilizes, after soil analysis, with 200 kg of reactive phosphate Arad, applied at once, in the beginning of the rainy season, and 200 kg/ha of N:P:K (30:00:20), divided in two parcels, one applied in the beginning of the rainy season and the other at the end of the rainy season. The lotation rate is of 20 cows, 1 bull and 17 offspring (5 males and 8 females), until weaning.

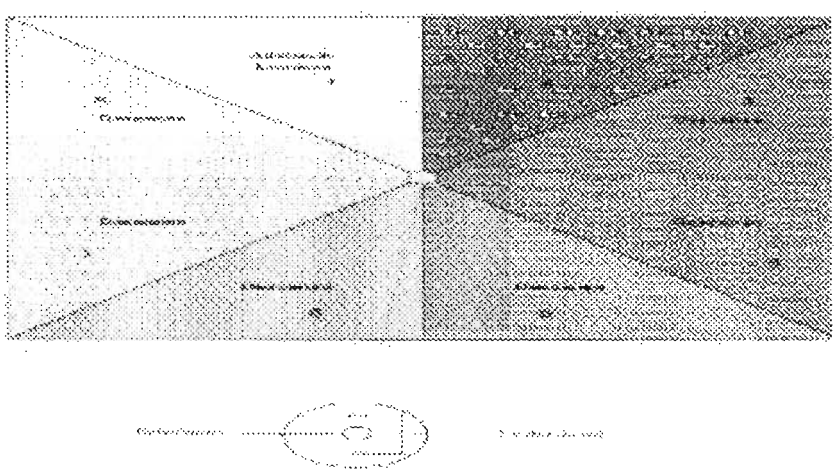

Figure 1. Model for division of eight plots for intensive rotational grazing system, with resting area
Source: (14).

Were taken around 500 m^2 for resting area, having drinking vessel, through for mineralization, and natural shadowing for animal comfort. The zootechnic installation destined for milk production are made of a milking room for animals, two rooms for calves, one room to receive the milk and one store. Figures 2,3,4 and 5 illustrates the implanted module, with that pasture, resting area, zootechnic installations and trees of african mahogany (*Kaya ivorensis*), planted along the boundaries fences of the pasture areas, searching to increase value to the property and make better animal comfort. The pasture was divided with fences of two electrified wires, up 0,70 m and 1,10 m of the soil, with corridor that access the resting area to the milking installations.

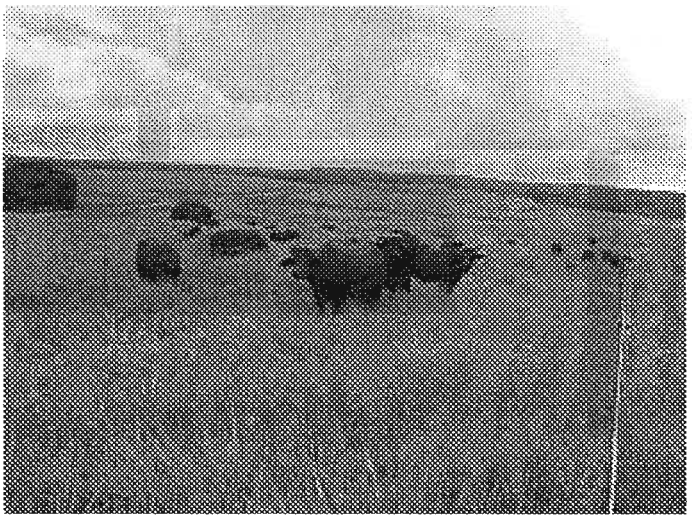

Figure 2. Buffaloes managed on intensive rotationed grazing of braquiarão (*Brachiaria brizantha*) and star grass (*Cynodon nlemfuensis*), in plots divided by electric fence.

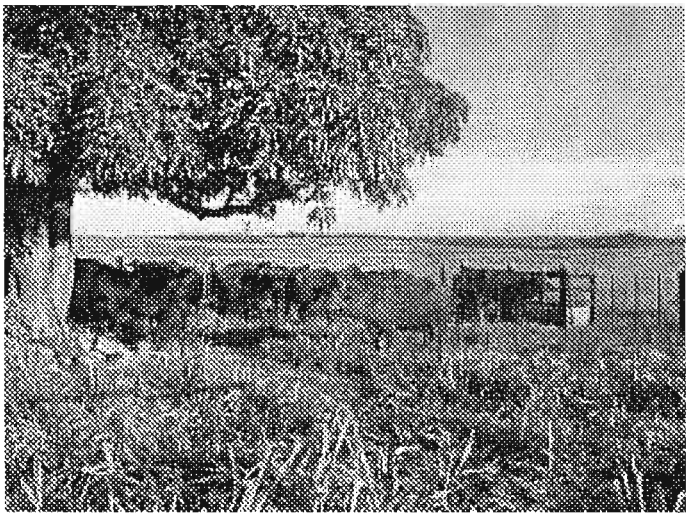

Figure 3. Resting area with drinking vessel, through for mineralization and natural shadow for animal comfort.

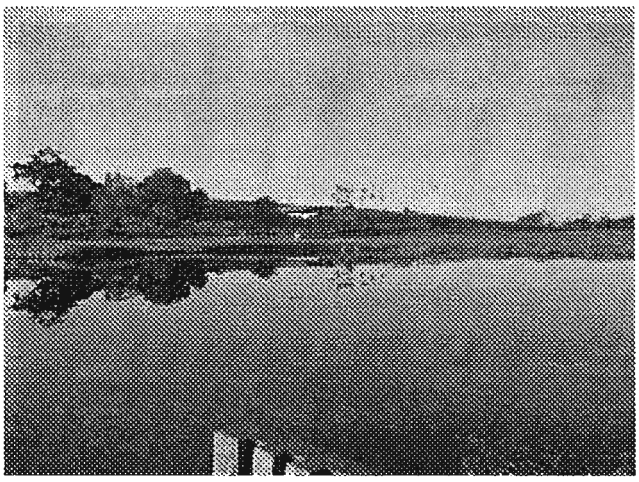

Figure 4. Artificial lake, for bath, animal comfort and fishery and milking installations.

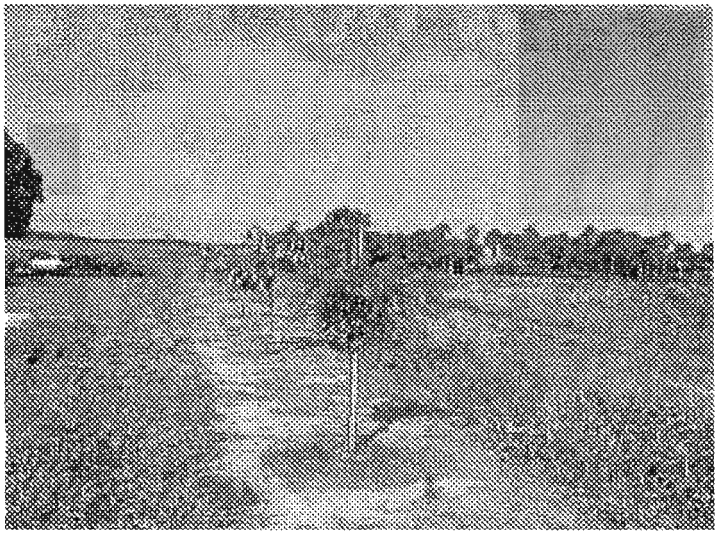

Figure 5. Trees of african mahogany (*Kaya ivorensis*) in the pasture area, to add value to the property and better animal comfort.

The animal are vaccinated against Foot and mouth disease, on the months of may and november, and only the females, from three to eight months old, against brucelosis. The vermifugation of the calves is made with vermifuge of large spectrum, on the first week and on the 30, 60 and 180 days of age. The cows are checked annually against brucelosis and tuberculosis. To combat ectoparasits, mainly the *Haematopinus tuberculatus*, is used aqueous solution of indian nim (*Azadirachta indica*) extract, take for the fresh leaks, during twelve hours in alcohol, that work as an extraction of the principle, in closed vessel. This solution may be filtered on fine screens and diluted in water on 5 % concentration.

Cows and calves stay together on the pasture during the day and separated at 5 p.m. The cows stay in the pasture by night and return to the barn at 6 a.m. for milking, when all the milk is taken. The calves are led naturally with the milk produced during the day. The calves are weaned when weighing 240 kg, with about 10 months old. When are sold for regrowth and fattening, with exception of two female calves that stay to replace the 2 cows sold annually, and one of eventual death.

CHARACTERISTICS AND PRODUCTIVITY OF THE PRODUCTION SYSTEM

Table 1 and 2 shows the execution, investment values and maintenance costs to implant a 10 ha module of intensive rotationed grazing to manage 20 cows, 1 bull and 17 calves until weaning.

Table 1. Investment to implant a 10 ha module of rotationed intensive pasture to manage 20 cows, 1 bull and 17 calves until weaning.

OPERATION	*UNITY*	*QUANTITY*	*VALUE (US$1.00)*
RECUPERATION OF DEGRADED AREA			
CLEANING/PILING	***TRACTOR/HOUR***	***40***	***654.55***
PLOWING	***TRACTOR/HOUR***	***25***	***136.36***
HARROW/LEVELING	***TRACTOR/HOUR***	***40***	***218.18***
SUBTOTAL	-	-	*1,009.09*
ACQUIREMENT AND SEEDS PLANTING			
SEED WITH 32 % OF CULTURAL VALUE	***KG***	***100***	***58.18***
SEED WITH 32 % OF CULTURAL VALUE	***TRACTOR/HOUR***	***5***	***27.27***
SUBTOTAL			*85.45*
CONSTRUCTION OF RURAL INSTALLATION			
CONVENTIONAL PERIPHERAL FENCE	***METER***	***800***	***581.82***
ELECTRIC FENCE FOR DIVISION OF PADDOCK	***KM***	***1,2***	***174.55***
TROUGH	***UNITY***	***1***	***36.36***
DRINKING VESSEL	***UNITY***	***1***	***72.73***
MILKING ROOM AND DEPOSIT (90 M^2)	***UNITY***	***1***	***3,272.73***
SUBTOTAL	-	-	*4,138.18*
ANIMAL ACQUIREMENT			
COW	***UNITY***	***20***	***4,363.64***
REPRODUCER	***UNITY***	***1***	***363.64***
SUBTOTAL	-	-	*4,727.27*
AREA ACQUIREMENT			
DEGRADED AREA	***HA***	***25***	***909.09***
SUBTOTAL			*909.09*
TOTAL INVESTMENT			*10,869.09*

US$1.00 = R$ 2,75.

Table 2. Maintenance costs of a 10 ha module of intensive rotationed grazing to manage 20 cows, 1 bull and 17 calves until weaning.

OPERATION	*UNITY*	*QUANTITY*	*VALUE (US$1,00)*
ACQUIREMENT AND APPLICATION OF FERTILIZER			
REACTIVE PHOSPHATE OF ARAD	***KG/10 HA***	***2,000***	***218.20***
N:P:K (30:00:20)	***KG/10 HA***	***2,000***	***338.18***
REACTIVE PHOSPHATE OF ARAD	***MAN/DAY***	***5***	***20.00***
N:P:K (30:00:20)	***MAN/DAY***	***5***	***20.00***
SUBTOTAL			*596.36*
PASTURE CLEANNESS			
CLEANING OF "JUQUIRA"	***MAN/DAY***	***10***	***39.63***
SUBTOTAL	-	-	*39.63*
HERD MANUTENTION			
MINERAL	***BAG***	***29***	***210.90***
FOOT AND MOUTH DISEASE VACCINE	***DOSE***	***60***	***16.36***
BRUCELOSIS VACCINE	***DOSE***	***15***	***9.45***
VERMIFUGE	***ML***	***500***	***27.27***
SUBTOTAL	-	-	*256.72*
WORKER			
MILKING MAN	***MAN/DAY***	***1***	***1,446.54***
SUBTOTAL	-	-	*1,446.54*
TOTAL			*2,339.63*

US$1.00 = R$ 2,75.

On Table 3 are presented the productivity index to the same module.

Table 3. Productivity value of a 10 ha module of intensive rotationed grazing in degraded area to manage 20 cows, 1 bull and 17 calves until weaning.

Parameter	Index
Support capacity on cultivated pasture	2,5 - 3,0 U.A./ha/year
Natality	86%
Mortality calves	2%
Mortality adults	1%
Discard	10%
Weight at weaning	240 kg
Milk production/300 days	1.200 kg

* 20 cows, 1 bull e 17 calves (9 males e 8 females), until weaning.

The revenue of the commercialization of the products of the system shown on Table 4. the milk average production will be 4 kg/cow/day, during 300 days of lactation. The selling of the males after weaning, for regrowth and fattening, will be of eight animals with 240 kg of alive weighted the females, in number of the five, will be sold for reproduction, while to of them will be sold to slaughtered.

Table 4. Annual revenue of the commercialization of milk and excedent animals.

PRODUCT	*UNITY*	*QUANTITY*	*INCOME (US$1,00)*
MILK	*LITER*	*20.400*	*3,709.09*
CALF FOR FATTENING	*ANIMAL*	*8*	*768.00*
FEMALE FOR REPRODUCTION	*ANIMAL*	*5*	*480.00*
COW TO DISCARD	*ANIMAL*	*2*	*363.63*
GROSS INCOME	-	-	*5,320.72*
MAINTENANCE COST	-	-	*2,339.63*
FINANCIAL COST INVESTMENT (6% FOR YEAR)	-	-	*652.36*
AMORTIZATION (10% FOR YEAR)	-	-	*1,086.90*
NET INCOME	-	-	*1,241.81*
NET INCOME/MONTH	-	-	*103.63*

US$1.00 = R$ 2,75.

On the Table 5, 6 and 7 are presented the execution investment values and maintenance costs to implant the system, as also points out the revenue, using home labor what represents a monthly met revenue superior in around 145 % (US$ 253.45 vs. US$ 103.63).

Table 5. Investment to implant a 10 ha module of intensive rotationed grazing with 20 cows, 1 bull and 17 calves until weaning, using home labor.

Operation	Unity	Quantity	Value (US$1,00)
Recuperation of degraded area			
TO MAKE THE AREA ARABLE	***HECTARE***	***10***	-
ACQUIREMENT AND SEEDS PLANTING			
SEED WITH 32 % OF CULTURAL VALUE	***KG***	***100***	*58.18*
SEED WITH 32 % OF CULTURAL VALUE	-	-	-
SUBTOTAL			*58.18*
CONSTRUCTION OF RURAL INSTALLATION			
CONVENTIONAL PERIPHERAL FENCE	***M***	***800***	*465.45*
ELECTRIC FENCE FOR DIVISION OF PADDOCK	***KM***	***1,2***	*130.90*
TROUGH	***UNIT***	***1***	*29.09*
DRINKING VESSEL	***UNIT***	***1***	*58.18*
MILKING ROOM AND DEPOSIT (90 M^2)	***UNIT***	***1***	*2,781.81*
SUBTOTAL	-	-	*3,465.45*
ANIMALS ACQUIREMENT			
COW	***UNIT***	***20***	*4,363.63*
REPRODUCER	***UNIT***	***1***	*363.63*
SUBTOTAL	-	-	*4,727.27*
AREA ACQUIREMENT			
DEGRADED AREA	***HA***	***25***	*909.09*
SUBTOTAL			*909.09*
TOTAL INVESTMENT			*9,160.00*

US$1.00 = R$ 2,75.

Tabela 6. Costs to maintain a 10 ha module of intensive rotationed grazing in degraded area to manage 20 cows, 1 bull and 17 calves until weaning, using home labor.

OPERATION	*UNITY*	*QUANTITY*	*VALUE (US$1,00)*
ACQUIREMENT AND APPLICATION OF FERTILIZER			
REACTIVE PHOSPHATE OF ARAD	***KG/10 HA***	***2.000***	***218.18***
N:P:K (30:00:20)	***KG/10 HA***	***2.000***	***338.18***
SUBTOTAL			*556.36*
HERD MAINTENANCE			
MINERAL	***BAG***	***29***	***210.90***
FOOT AND MOUTH DISEASE VACCINE	***DOSE***	***60***	***9.45***
BRUCELOSIS VACCINE	***DOSE***	***15***	***9.45***
VERMIFUGE	***ML***	***500***	***27.27***
SUB-TOTAL	-	-	*256.72*
TOTAL			*813.09*

US$1.00 = R$ 2,75.

Tabela 7. Annual revenue of the commercialization of milk and excedent animals in a 10 ha module of intensive rotationed grazing in degraded area managing 20 cows, 1 bull and 17 calves until weaning, using home labor.

PRODUCT	*UNITY*	*QUANTITY*	*REVENUE (US$1,00)*
MILK	***LITER***	***20.400***	***3,709.09***
CALF FOR FATTENING	***ANIMAL***	***8***	***768.00***
FEMALE FOR REPRODUCTION	***ANIMAL***	***5***	***480.00***
COW TO DISCARD	***ANIMAL***	***2***	***363.63***
GROSS INCOME	-	-	***5,320.72***
MAINTENANCE COST	-	-	***813.09***
FINANCIAL COST ON INVESTMENT (6% FOR YEAR)	-	-	***549.81***
AMORTIZATION (10% FOR YEAR)	-	-	***916.00***
NET INCOME	-	-	*3,041.81*
NET INCOME /MONTH	-	-	*253.45*

US$1.00 = R$ 2,75.

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