

ALTERNATIVE SYSTEMS FOR FEEDING BUFFALOES IN AMAZON REGION

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ABSTRACT

Hereafter are introduced the ecosystems of buffaloes raising in Amazon Region, represented by native pastures, where the production index are not considered satisfactory, due to its climate conditions and hydrological aspects, that interferes on the on the availability and nutritional value of the forages and consequently on the animal performance. Alternatives are related for the development of buffaloes raising in systems using cultivated pastures, of higher forage quantity, better quality, on integrated systems with native pasture, in intensive rotationed system, utilizing supplementary feeding, with agroindustry by-products and others sources, attending demands to keep meat and milk production, besides silvipastoril system, in view of bettering the economical, social, biological and ecological aspects of land use in Amazon Region.

Key words: Amazon, native and cultivated pastures, supplementary, silvipastoril system

ANTECEDENTS

The domestic buffalo (*Bubalus bubalis*) history has its origin in Asia. This specie was taken to Africa, later introduced in Europe and recently in America. In Brazil, its introduction occurred in 1895, with animal of the Mediterranean race, proceeding from Italy, to Marajo island, Para State, through the farmer Vicente Chermont de Miranda. Thereafter, several importations of buffaloes lots were made to others brazilian regions. Buffaloes plays an important role in Asian's agriculture, as milk, meat and work production. On the Latin America countries, especially in Brazil, its contribution on this aspect can be of great importance, in little and medium size farmers. In the last years, buffaloes have been an important alternative source of food production to supply the needs of the developing countries, as they make good use of the forages of poor quality, in area of difficult utilization by others species and by agriculture (29, 30, 35).

Buffaloes grows and survived in the natural conditions of Marajo island, and only after the fifties, the "marajoares" farmers decides to explore them as a productive activity. Latter on, the beginning of the sixties, were introduced animal of the races Murrah and Jaffarabadi, on the north and southeast of Brazil. These animals adapted well to the tropical conditions and found in Amazon its ideal habitat, where have shown excellent aptitudes for meat, milk and work production, besides the satisfactory reproductive index, causing no damage to the environment (4, 20, 24).

According to the estimative, the buffalo national herd gets up to 3.5 millions of heads. Its important to mention that the Para State, Brazil, has about one million of heads, that are distributed, basically, on the Marajo island, and in the low and medium Amazon, and the highland cultivated pastures. The herds annual growing tax is around 10%, almost for times the one of the bovine in Brazil, although others estimatives also say that this tax is close to 16%. However according to IBGE (1, 2), the buffalo population in Brazil is around 1.6 millions of animals.

Buffaloes found in Amazon region its ideal habitat, with the primacy of sheltering the three subspecies existents in Brazil (*bubalis*, *kerebau*, *fulvus*), grouping animals of the Mediterranean, Murrah, Jaffarabadi and Carabao, besides of the "Baio" type. They are excellent meat, milk and

work producers, and considered as ecological animals, producing and reproducing in bad lands of flooded native pastures, where bovine don't get to survive (24 26, 29).

Beginning from the seventies were obtained the first research result on buffalo milk and meat performance in Amazon region, through Brazilian Agricultural Research Organization - Embrapa Eastern Amazon, in Belem, Para State, Brazil. Nowadays, Embrapa has a significant pile of buffalo knowledge, that indicates these animals as the new ecological potion to occupy the huge areas of pasture in Amazon region, producing and reproducing in a exceptional manner, with us damage to the environment and positive effects to local socioeconomy. According to the results of research, buffalo raising is the viable alternative to make good use of the flooded areas, due to its unproper utilization by others breeds. Also, there are technologies for the developments of buffalo in ecosystems of highland cultivated pastures, through the recovering of degraded pasture areas (10, 29).

THE ACTUAL MOMENT

The low rentability of buffalo raising on the traditional systems on farming in Amazon makes this activity little economically attractive, with the prognostic that at medium and long time, only will remain on it the ones who have the competency to adapt himself to the new realities of the economical changes. This fact has induced farmers to transfer part of the herd to highland pasture areas, on making investments on the recovering of altered areas, as way to raise productivity to make it competitive.

Also, farming on cultivated pastures in Amazon region has been stigmatized as responsible for the low efficiency on land use. The reduced use of imputes and technologies in the years sixties and seventies, have been taken over by more productive systems and perennial pastures, as results of the use of technologies. The profit of farming depends on the efficiency of the exploration, on the rational management of the pastures, on the herd genetics betterning, on the intensive production of meat or milk, on high productivity, with economicity and commercialization.

Small peasants adopt buffalo raising as savings, as it is strong coin and of easy return. The profit of this activity becomes more touchable is the productive sector adopts new technology and conciliates administration and pastures maintenance costs. Evidently, the reduction of deforesting is the key to preserve florets resources. On this way, the correct utilization of farming in areas of degraded pastures seems to be the obvious alternative to reduce deforesting.

Nowadays, the intensive rotationed system of pasture has been of importance to the regional buffalo raising, since it shows superior on productivity/ha, possibility of pasture perenization and, along the years, makes better the microbiological, chemical and physical characteristics of the soil, as well preserve the environment, avoiding the pressure of deforesting new areas of forest. It is important to point out that farming in Amazon region faces the serious problem of pasture degradation, in favour of biological and economical results of low efficiency in the good use of the soil (10).

Under the biological point of view, buffalo raising is supported in Amazon by its climate, soil, genetically variability of the forages, adaptability of the animal, and physic space. The climatic variables allows vegetative growing of the forages throughout the whole year. The soil that has good physical proprieties, needs to be fertilized, to maintain productivity and forage lasting. The genetically variability of the forages allows to face the adversities of the humid tropics. There are animals with genetic potentiality to produce meat and milk, in satisfactory levels, while the land relatively cheap, is a important factor on the production cost (10). In Amazon, for a long time, meat production was considered the main activity of buffalo raising. However, nowadays, milking starts into-business, considering the potential of this specie in producing milk with low costs and high profit in the processing, as also by population demands for its derivatives.

Besides dynamics, buffalo raising in Amazon is well diversified, being the animals submitted to several manners of management, differentiated according to the economical and social characteristics of each production system. The small farmers, generally have only flooded native pastures and use "marombas" (suspended corrals) to keep the animals from flooding. These, most of the time face high prejudice, due to the weight loss, delay in the slaughtering age, reduced offspring and even death. The medium farmers have, besides the flooded native pasture, highlands areas, to

where transport their animals on the critical periods of flooding. These areas, however, are made of native forages of low nutritional value. There are, also, the big farmers that have the three types of ecosystem, that is, flooded native pasture, highland native pasture, and highland cultivated pasture this one of good nutritional value. Regarding to the zootechnic and sanitary management of the herds, there is a low technique level, mainly among small and medium farmers. It is not yet sufficiently adopted the technologies developed about the relations among the different variables of the environment, such as climate, feeding, management practices and rural infrastructure, and the pathological and physiological state of the herds (29).

ECOSYSTEMS OF RAISING

In the Brazilian Amazon, buffalo raising is basically developed in systems of raising at pasture, utilizing four different pasture ecosystems: 1- flooded native areas of the estuary, distributed on Marajo island that concentrates most part of the herd; 2- flooded native areas, located on the low and medium Amazonas; 3- native highland and 4 – highland cultivated, in areas of forest. On this last ecosystem it is being used more productive forages of better nutritional value, on lands of animal with an outstanding genetic pattern. Also, are raised in systems that combines native and cultivated pastures (29).

Until the fifties, buffalo farming in Amazon was based on native pastures. The effective was little, due to the low support capacity of the pastures, reduced forage availability and low nutritional value (41). Being from the sixties this activity wanted to be developed, also, in highland cultivated pastures, on in systems involving these two conditions (6, 20, 30, 38, 39)

NATIVE PASTURES

The native pastures of Marajo islands are stable ecosystems, explored with beef cattle raising, in extensive system of management, for more than 300 years, with reduced levels of degradation. The native pastures of flooded areas, mainly the ones of the low and medium Amazonas region, have performed a role of great relevancy on the regional farming context. Besides of being the main feeding source of farming, its importance grows by the time that grows the demand for more animal protein and grows the interest for buffalo raising that, because of its particularities, is able to explore more efficiently its potential (37). The main limitations of these pastures, however, has been the difficulties to manage the land during flood seasons, when the areas of pasture are kept flooded. When the flood lasts longer the prejudice are considerable (29,39).

The native pastures of “varzea” have important role on the development of buffalo raising in the Brazilian Amazon, by processing high potential production forage of good nutritional value. These pastures are located on the borders of the Amazon river and its tributaries, lakes of muddy water and areas of the estuary. The bigger extension of these pastures occurs on the low and medium Amazonas and part of the Marajo island (32,39).

Referring to animal feeding, the gramineous represents one of the main components of this ecosystem and are called “amphibians”, because that survive floating on submerged on the flooding period, vegetating during the low tide of the waters. On the season of the high tide, that coincide with the rainy season, its stay unavailable for animal feeding. On this season, only buffaloes can better utilize them. On the “varzea” pasture consumed by buffaloes predominate the gramineous *Echinochloa polystachya*, *Hymenachne amplexicaulis*, *Paspalum fasciculatum*, *Paspalum repens*, *Leersia hexandra* e *Oryza sp.* The gramineous that make up the native pastures of “varzea” have high production potential and good nutritional value, with medium level of brut protein of 13.3% and digestibility “in vitro” of the organic matter 52.3% (6). The soils are of good fertility and stay flooded during six months a year, from January to July, receiving the setting of the sediments suspended in water of the Amazon river and its tributaries. The mineral of the forages are enough to attend the maintenance level and animal production. Therefore, the great problem is the flooding of the pastures by river waters.

CULTIVATED PASTURES

In the last year, the *Brachiaria brizantha* has been the gramineous most used by the farmer in Amazon, due to its high productivity of forage, persistency, good regrowth capacity, resistance to dryness and fire, besides its good nutritional value. Plants of this genus adapt to varied conditions of soil and climate, but its expansion was mainly because of its adaptation to the Amazon soil conditions of low and medium fertility, that produces forage reasonably (31,33,41,43).

Currently, besides the *B. brizantha* are being utilized others promising gramineous of the genus *Brachiaria* (*Brachiaria humidicola* - quicuí-da-amazônia), *Panicum* (*Panicum maximum* - colômbia, tanzânia e mombaça) e *Andropogon* (*Andropogon gayanus* - andropogon). More recently, the star grass (*Cynodon nlemfuensis*) has showed excellent adaptation to different soils, promoting gains on buffalo meat and milk production.

ANIMAL PRODUCTIVITY

In our country, on the traditional farming systems, buffaloes have shown low performance on meat production, weighing around 350 kg, between two and three years old. However, using technology, mainly the ones that involves feeding systems, meat production is substantially increased, in the same way as happens with the output and quality of its carcasses (29).

According to the age and alimentary regime, variations occurs on the percentages of the carcass. Buffaloes kept on the severe feeding system, when 18 months old, possess 4.8% of fat, what gives value to the meat pieces, while when at 24 months, this rate rises to 15%, concluding that the animal shall be slaughtered younger, under better elementary regime, viewing higher carcass output.

One of the more important buffalo functions is, undoubtedly, milk production. This is, almost ever, the main goal, moreover in some asiatic countries where religion does not allow meat consumption. In Brazil, although buffaloes are raised for meat production, milking activities have shown excellent results, being considered an alternative to better the socioeconomy of the agricultural sector, through the transformation and commercialization of its derivatives (6, 21, 24, 29).

The Para State is one of Brazil's biggest powdered milk importer. The milk consumption in Brazil is about 270 g/day/habitant, while the Health World Organization recommends 400 g/day/habitant. In Para State, there is a need to implement an intensive program of milk production to attend human consumption, of which demand by liquid milk will be able to absolve about two millions liters/day. The buffalo milk presents industrial output for milk products 40% superior to the milk of bovine cow. The most traditional derivative produced exclusively from buffalo milk is the mozzarella. This product can be exported to others regions of the country and to other countries (11, 12, 13, 14, 15, 16, 24, 29, 40).

MEAT PRODUCTION

Production on Native Pasture

On the native pastures of Marajo island, of reduced forage availability and low nutritional value, with mineral supplementation, males buffaloes of Mediterranean, Carabao and Jaffarabadi, reached weight, when two year old, of 369 kg, 323 kg and 308 kg, respectively. In other ecosystem, on native pastures of "varzea" of the medium Amazonas, males buffaloes, also two years old of the "Baio" type and Mediterranean, Carabao and Jaffarabadi races, reached weight of 336 kg, 402 kg and 382 kg, respectively. De females reached weight 320 kg, 373 kg and 326 kg, in the same order (7).

In the same ecosystem, the gain of weight of Murrah and Mediterranean buffaloes varied from 0.114 kg to 0.692 kg/animal/day, due to climate influences (8). On females (22) observed lost of 0.003 kg and gain of 0.426 kg, of which variation is mainly associated to hidric conditions, that interferes on the availability and nutrition value of the forage, as well on its botanical composition. Better performances on these ecosystems are obtained where the animals are managed in pasture that predominant on the herbaceous extracts, gramineous of good availability and quality of forage, such as *E. polystachya*, *H. amplexicaulis*, *L. hexandra*, *Oryza* spp, *P. repens*. On the that predominates *P. fasciculatum* gramineous of low nutritional value and reduced available forage, the ponderal performance are more reduced. The better time for animal fattening on the pasture of the

low and medium Amazon occur from July to December. However, there are other factors that interfere with animal performance, such as the level of the river water, hematophagous insects attack and amount of rains on this period.

Production on Cultivated Pasture

On buffalo farming systems in highland cultivated pastures, for meat production, on traditional farming systems, utilizing mainly conditions grazing, in different places of Amazon region, the medium daily gain of weight varied from 0.331 to 0.680 kg (7, 8, 19, 22, 28). In intensive grazing rotated system, using technologies that elevate the sustained productivity of farming, and allows to incorporate the large areas of degraded pastures to the productive process, avoiding the opening of new farming frontiers on tropical forest areas, buffaloes show high potential for meat production.

The researches show that in the intensive grazing rotated system, on cultivated pasture, with fertilization, buffaloes reached alive weight around 500 kg, when younger than two years old. In Embrapa Eastern Amazon, in Belem, Para State, Brazil, buffaloes of the Mediterranean race, in pastures of *Panicum maximum*, cv. *tobiatã* e *Brachiaria humidicola*, intensive grazing rotated system, with fertilization, use modules of six plots in occupation period of four to seven days and resting of 20 to 35 days, reached gains per hectare from 3 to 4 times superior to the ones found on the traditional systems of the region, with lotation tax of 1.5 to 3.2 U.A./ha/year. The gain of weight/ ha/ year was of 442 to 645 kg, and daily average of 0.474 to 0.524 kg/ head, what represents daily weight gains/ ha of 1,422 kg to 1,778 kg. The net revenue was approximately US\$ 150/ha/year. The average of the total forage availability varied from 4,017 to 4,246 kg of dry matter/ha/year, at the entering of the animal on plots, staying a medium residue of forage of 2,574 to 2,621 kg of A.U./ha/year, on the leaving of the animals from the plots. The average level of crude protein on the leaf varied from 9.5% to 12.8% and the digestibility "in vitro" of the dry matter on the leaf was of 53% to 60% (36).

On private farmers of Castanhal and Bonito, Para State, Brazil, in pastures of *Brachiaria humidicola* e *Brachiaria brizantha*, in lotation tax of 2.4 head/ha, buffaloes of Murrah race were fattened for commercialization as "baby buffalo", on intensive rotated grazing system, with fertilization, utilizing modules of eight plots, using occupation periods of five days and resting of 35 days, and was reached daily weight gain of 0.530 kg, that corresponds to a daily weight gain/ha of 1,272 kg meaning three times the observed on the traditional systems of farming.

The "baby buffalo" meat were slaughtered in abstinence of food and water, between 20 and 23 months old, weighing from 432 to 441 kg. In Amazon, according to the classification of Brazilian and Paraense Association of Buffaloes Farmers, the title of "baby buffalo" is given to animals slaughtered between 18 to 24 months of age, weighing alive 400 to 450 kg and its meat has attractive flavor, less saturated fats and the cholesterol, being commercialized in Belem, Para State, Brazil, with good acceptance and better price, being supposedly not hazardous from heart disease (35, 42).

On the "baby buffalo" carcass evaluation (18) was observed that its fat is well distributed, with marbled meat and excellent visual aspect. The carcass out put of these animals was 47,35 % in relation of the weight at the farm, similar to the ones mentioned in literature (24) and varied from type C - regular to type B - good, with caloric value of 131 cal/100g of meat, little smaller than the one mentioned in USDA (42), suggesting that the buffalo meat, mainly of "baby buffalo" has less calories than the bovine meat, being probable its indication as alternative for more healthy diet for the population. The cholesterol average determined was of 60 mg/100 g of meat, similar to the one found by USDA (42), of the 61 mg/100g, while the one found in bovine meat is of 90/100 g.

Integrated Production Systems

Farming is a very important activity for the social economical development of the low and medium Amazon. On these ecosystems pastures are better utilized on the dry season. On time of flooding. The farmers take the animals out of the varzea and keeps them most of the time in elevated corrals

("marombas") or in areas called "tesos" (areas of more altitude), where they face precarious conditions of hygiene and feeding. The other alternative is to withdraw the herd from the varzea moving them to the highlands, to areas of native pastures of savanna well drained called "covered fields" (3). Another alternative, considered more adequate under the social economical, ecological and biological point of view, it's the utilization of systems that integrates the native pastures, during the dry period of the year, while existents high forage availability of good quality, with the pasture madden of cultivated gramineous, in good quantity and quality, during the rainy season of the year (7, 8, 22).

This system consists on raising sucking calves on native pasture of "varzea", with are weaned on the begging of the dry season, in august, which stay on this ecosystem during all the favorable period. Later on, in the beginning of the rainy season, these animals are taken to highland cultivated pastures for fattening, from january to august, where are kept in allotment rate of 3 A.U./ha, with supplementary mineral. This system presets excellent productive and economical performance on the finishing of the buffaloes, whet allows the animals to reach 450 kg of liveweight when less than two years old (5, 8) and on the better female development, with positive effect on reproduction (22).

Production with Supplementation

The system of buffalo meat production can be significantly increased by the use of supplemental feeding. These are several alternatives, with distinction to the addition of agroindustry by-products as ingredients to elaborate rations that can attend the nutritional demands for milk and meat buffalo production, with low cost. The brans of wheat, corn, soybean, as well the cakes of coconut, oil palm, babassu, besides brewery, juice industry and farm residues, are sources of supplementation (34).

On Marajo island, males buffaloes of the Murrah race fattened in continuous grazing of *Brachiaria humidicola*, on the allotment rate of 2 animals/ha, gained, in average, 0.730 kg and 0.741 kg, with 2 and 4 kg/animal/day of supplemental feeding, respectively, on the dry period (july to december), while the females 0.860 kg and 0.832 kg, in the same order. The ration had 59% of wheat bran, 35% of oil palm cake and 2% of minerals (21).

In systems of semi-intensive rotationed grazing *Brachiaria humidicola*, in Belem, Para, Brazil, with supplemental feeding made of 1 kg of wheat bran, with 2% of minerals mixture, for 200 kg alive weight and 10 kg of sugar cane (*Sacharum officinarum*)/head, buffaloes males Murrah and Mediterranean races gained daily 0.971 kg and 0.877 kg, respectively. The net income indicated that this technology increases the productive and economical performance of the fattening system in supplemented pasture (9).

In intensive rotationed grazing system of *Brachiaria humidicola*, in Belem, Para, Brazil, the supplemental feeding made of concentrated ration, with about 13% of crude protein and 60% of total digestible nutrients, made of corn bran (70%), wheat bran (20%) and toasted soybean bran (10%), in the rate of 1 kg for each 150 kg of alive weight, increased only about 5% the ponderal development of buffaloes Murrah (0.485 kg vs. 0.464 kg). The gramineous had on the leaf, protein levels higher the ones considered critical for the positive balance f the nitrogen (6%). The economical evaluation indicated that is not interesting to supplement fattening buffaloes, on the rainy season, probably due to a higher forage availability of better nutrition value. Better performance on meat production can be obtained with the use of gramineous, more supplemental feeding, basically on the dry season.

The prohibition of the use of anabolitics by most of the countries, included Brazil, justifies the effort to find an alternative to supplement buffaloes, basically when the forage is of litter nutrition value. Thus the use of free aminoacids, that come from an external source, with minerals and vitamins, constitutes supplemental source to favour the earlier slaughter of buffaloes. The application of a product resultant from acid hydrolyses of bovine organs associated to aminoacids, minerals and vitamins, viewing to slaughter precociously buffaloes Murrah, on cultivated pasture of *Brachiaria humidicola*, on intensive rotationed system, indicated that the animals who had supplemental feeding had a superior performance, reaching slaughter weight 422 kg, when 20

months old, corresponding to a daily weight gain of 0.649 kg, while the control animals reached 410 kg, with daily gain of 0.549 kg.

Confined Production

The system of confined buffalo farming constitutes a viable strategic of management, as it intensifies animal production and productivity constantly during periods of the year, with the objective of regular supplying of the animals for slaughter, on state of emergency, such as accidental fire, plagues and diseases of the pastures and on dryness period.

The productive and economical behavior on the fattening of confined Murrah buffaloes, in Castanhal, Para State, Brazil, on adequate and partially covered installations, with diet made of elephant grass (*Pennisetum purpureum*), wheat bran and protein salt indicated not to be economically viable this system of farming, on local conditions. The confining area had plenty water of good quality. The animals reached medium final weight of 487 kg, corresponding to a daily gain weight of the 0.814 kg. However, it was observed daily weight average of only 0.320 kg during one fattening period, fact probably due to climate conditions, with high temperature and humidity, and to the manure accumulation, what caused discomfort and, consequently, reduced performance. To avoid these problem, was allowed the access to plenty of good quality water to drink and bath, in shadow, between 10 a.m. and 3 p.m., what allowed the cleaning of the animals and better thermic regulation, favoring comfort and the return of the weight gain in satisfactory levels. This fact may be responsible by the reduced economical performance of the confinement, that did not have net income compatible to this technology. Therefore, there is the need of practices to control the environment to raise the productivity of confined buffaloes

MILK PRODUCTION

Production on Native Pasture

Buffaloes were not used for commercial milk production on the Brazilian Amazon, mainly because most of them are raised in flooded areas. These areas, in general, has difficult access, characterized by the extensive system of farming, where such activity, in some cases developed well. However, nowadays, there are several farms that are developing for milk production, on cultivated pastures of good disposal and nutritive value.

In native pastures of alluvial soils of "varzea" in the medium Amazon region (25), females buffaloes of Baio type produced in the first and second lactation, on a daily milking, 1,024.57 kg of milk, in 253 days, with daily production of 4.05 kg and 8.32% of fat, pointing out that buffaloes have the capacity to produce meat satisfactory on this kind of pasture.

Production on Cultivated Pasture

Today in some countries of the world, the use of selection, management, feeding and technical programs have promoted progress on buffalo milk productivity and the production of 3,000 liters/females/lactation, considered record three decades ago, was supplanted by cows that produce 4,000 to 6,000 liters/lactation of 300 days (13, 24).

Buffaloes have a exceptional long lasting productivity and can produce milk up to 18 years of age, mainly when well management and adequate feeding to attend its nutritional demands for maintenance and production. In Brazil, milking buffaloes are considered excellent the ones that produces in average, more than seven liters/day during 300 days. It is important to mention that the buffalo cow "Limeira", of Embrapa Eastern Amazon, produced 4,645 of milk, in 365 days of lactation, with 20 liters/day, on the top of lactation, in system of flooded cultivated pasture of *Echinochloa pyramidalis*, with supplementary feeding made of wheat bran and 2 % of mineral salt, in the proportion of 1 kg per each liter of milk produced (29). On the Table 1 are the buffalo milk production data from the herd of Embrapa Eastern Amazon, raised on system of cultivated pasture, only with supplementary mineral, in Belem, Para State (23).

Table 1. Milk production of buffalo cows Mediterranean and Murrah-Mediterranean.

Type	Lactation (day)	Fat (%)	Milk (kg)
Mediterranean	316	7,7	2.055
½ Murrah - ½ Mediterranean	338	7,3	2.062
¾ Murrah - ¼ Mediterranean	340	6,4	1.958

Other very important aspect on buffalo milking activity is the profit of the milk to make milk products. It is important to point out that good feeding interferes positively on milk production and on its industrial profit. On Table 2 are the comparatives profits between buffalo cow and bovine cow for elaboration of milk products.

Table 2. Productive of buffalo milk products in relation to cattle milk.

Dairy product	Milk/Product (kg milk/kg product)		Buffalo milk/Cattle milk (%)
	Buffalo milk	Cattle milk	
Yogurt	1,20	2,0	40
White cheese ¹	4,56	6,0 - 8,0	35
Mozzarella	5,50	8,0 - 10,0	39
Provolone	7,43	8,0 - 10,0	20
Marajo cheese ²	6,00	10,0 - 12,0	41
Creamy milk sweet	2,56	3,5	29

¹ Manufactured at the Embrapa Eastern Amazon. ² Manufactured in Marajo island farms.

SILVIPASTORIS SYSTEMS

The Agrossilvipastoris Systems, among which the silvipastoril, has been objective of researchs developed by Embrapa Eastern Amazon, viewing the use of degraded areas due to inadequate management, adding value to the land via on arboreous component, bettering nutrient cycling and animal comfort, representing attractive alternatives to maximize land use, with sustainability. Buffaloes raising for meat and milk production meets perfectly this context, with productivity and beneficial effects on socioeconomy and Amazon environment.

In Embrapa Eastern Amazon, Belem, Para State, Brazil, a silvipastoril system was implanted, in area of 5,4 ha, divided into six plots of star grass (*Cynodon nlemfuensis*), on intensive rotationed grazing with five days of occupation and 25 days of resting, with a central area having drinking vessel and had for feeding and mineral supplementation, where are begin fattened 25 males weaned buffaloes of the Murrah race, with ages ranging from 213 and 303 days, receiving supplemental feeding, on the rate of 1.25 kg of ration, with 14 % of crude protein, for each 100 kg of alive weight. These animals are also submitted to a weight gain test, for posterior semen selection and sampling. Along of the electric fences, *Khaya ivorensis* and *Azadirachta indica* are planted 4 m intercalated, and fertilized with chemical and organic fertilizer seeking to make better animal comfort and add value to the propriety. The firsts results (30 days) indicates a daily gain average of weight of about 0,600 kg/animal, considered still low, probably due to the adaptation period of the animals and of the availability and nutritive value of the forage that was old when the test began.

On excellent alternative for milking activities on degraded areas of Amazon is being developed in private farm in Rondon do Para, Para State, Brazil, in silvipastoril system, for buffalo milk production, in a module of 25 ha of cultivated pasture, having resting area, drinking vessel, had for mineralization and creep-feeding for supplementary feeding, milking machine, and a little dairy industry. The pasture is of *Brachiaria brizantha*, divided in twelve plots, in rotationed intensive grazing system, with fertilization, with three days of occupation and 33 days of resting, where will be kept 50 cows, 1 bull and 43 calves (22 males and 21 females), until wearing. The pasture is divided by electric fence, where are planted forestalls species such as *Khaya ivorensis* and *Azadirachta indica*, to better animal comfort and to add value to the propriety. Other alternative for meat and milk production on small private farms in Amazon, is being implanted in Primavera, Para,

Brazil, involving integrated systems of buffaloes for meat and milk production, poultry, fish, trees and others crops.

PRODUCTIVE AND ECONOMICAL INDICES OF BUFFALO MEAT AND MILK PRODUCTION IN AMAZON.

On the economical evaluation of intensive meat production, it is observed a net income of US\$ 85.00/ha, that corresponds to US\$ 139.00ha/year. This value is about three times higher than the one observed on the Amazon region, in farming systems using medium technology (US\$ 19.00 to US\$ 31.00 ha/year) and around 92% superior to the systems that use high technology US\$ 72.00 ha/year. The productive and economical index of meat production, in Amazon region, on the traditional and intensive systems are shown on Table 3.

Table 3. Productive and economical index on buffalo meat, in the traditional and intensive systems.

Parameter	Traditional	Intensive
Slaughter weight (kg)	350 - 400	450 - 500
Slaughter age (months)	24 - 36	18 - 24
Support capacity (U.A./ha/year)	0,5 - 1,0	2,0 - 3,0
Animal gain (kg/head/year)	120 - 160	200 - 250
Animal gain (kg/ha/year)	60 - 160	400 - 750
Gross income (US\$/ha/year)	23 - 61	153 - 287
Cost (US\$/ha/year)	8 - 13	52 - 78
Net income (US\$/ha/year)	15 - 48	101 - 209
US\$1.00 = R\$ 2,61		

On Table 4 can be observed the productive index that can be reached in a milk production system, using technology developed by research in Eastern Amazon, in a module of 25 ha, with cultivated pasture, in intensive rotationed grazing, settled in a degraded area, to manage 50 cows, 1 bull and 43 calves until weaning. The animal commercialization of the products of this module of 25 ha is 64,500 liters of milk, 21 calves for fattening and 5 cows to discard.

Table 4. Productive index module of 25 ha, on intensive rotationed grazing system.

Parameter	Index
Support capacity on cultivated pasture	2,5 - 3,0 U.A./ha/year
Nattily	86 %
Mortality calves	2 %
Mortality adults	1 %
Discard	10 %
Weight at weaning	240 kg
Milk production/300 days	1.500 kg

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