Buffalo Newsletter

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BULLETIN OF THE FAO INTER-REGIONAL COOPERATIVE RESEARCH NETWORK ON BUFFALO AND OF THE INTERNATIONAL BUFFALO FEDERATION - INCLUDES SHORT COMMUNICATIONS, RESEARCH PAPERS, TECHNICAL NOTES, ONGOING RESEARCHES

THE INTERNATIONAL BUFFALO FEDERATION MEETING ON OCTOBER 21, 2007

The International Buffalo Federation (IBF), since the foundation in 1985, has elected every 3 years his President who organized the World Buffalo Congress every time in a different continent.
The World Congress was and will be the best real occasion for all the scientists and technicians working in different buffalo fields to meet each other's, to discuss, to present results, to obtain the state of art of the progress of the buffalo in the world and to prepare exchange of scientists, visit and common projects.
This year the World Buffalo Congress was held for the second time, after 1997, in Italy in Caserta and a complete state of art of the research in Buffalo species was produced in the 1450 pages of the Congress Proceedings, published by the fascinating Italian Journal of Animal Science, edited by Avenue Media, Milan-Bologna.

During the Congress (October 19-22, 2007), that was very intensive and participated by more than 400 people coming from 39 Countries, the IBF meeting was held on October 21 at 5.00 p.m. by the President *prof. Luigi Zicarelli.*
The following representative members from 19 Countries were present:
– Argentina:*Marco Zava, Armando Rozemblum, John Nelson;*
– Australia: *Barry Lemcke,*
– Bangladesh: *Samad Khan delegated by Omar Faruque;*
– Brazil: *Joao Ghaspar de Almeida, William G. Vale*
– Bulgaria: *Tzonka Peeva;*
– Colombia: *Alfonso Bernal, J.A. Berdugo, Ricardo Botero;*
– Egypt: *Ibrahim Soliman;*
– India: *S. Ranjhan;*
– Iran: *Moossa Eslami, R. Pirmohammadi, Hamid Naderfard;*
– Italy: *R. Garofalo, A. Fagiolo, L. Iannuzzi, A. Coletta, G.M. Terzano; V.L. Barile, M.Mazzi, A. Casali, F. Infascelli;*
– Pakistan: *Talat Naseer Pasha, Nasir Hussain Shah;*
– Philippines: *Libertado C. Cruz;*
– Thailand: *Metha Wanapat;*
– Turkey: *Ozel Sekerden;*
– Trinidad: *Lillawatti Rastogi, Floyd Necles;*
– U.K.: *Bob Palmer;*
– USA.: *Hugh Popenoe, Thomas Olson;*
– Venezuela: *Jesus Reggeti, Hector Scannone;*
– Vietnam: *Mai Van Sanh.*

The General Secretary *prof. Antonio Borghese* distributed the list of the members, composed of 58 IBF representative members of 23 Countries, and informed that new members can be included in the list if proposed by a representative member, on condition that they work in buffalo field at high level, pay 100.00 $ as fee for the period 2007-2010. The proposal must then be accepted by the IBF Committee.

The following candidates were proposed, voted and included in the list: *Federico Romero* for Argentina, *Santosh Thomas and Aditya Misra* for India, *Safdan Ali Sial* for Pakistan, *Rangsun Parnpai* for Thailand, *Giuseppe Campanile* for Italy.
The General Secretary reported the IBF activity

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during the last 3 years, after the last World Buffalo Congress in Manila, Philippines in 2004. During this time further IBF meetings were held: in Paestum (Italy) on October 14, 2005 during the first Buffalo Symposium of Europe and the Americas, in Nanning (China) on April 20, 2006 during the 5th Asian Buffalo Congress, in Medellin (Colombia) on September 6, 2006 during the second Buffalo Symposium of Europe and the Americas.

The Secretary in Rome particularly promoted the relationships and links among the IBF members and the involved countries. The Secretary is the Editor of the Buffalo Newsletter, which is sent free of charge to 1600 addresses, people or Institutes interested to the developing of buffalo in the world. The Buffalo Newsletter shows the logos of FAO and of IBF, linking two important Institutions, but needs also financial support. People who participated to the Congress received n.22 of the Newsletter, edited in September 2007.

Finally we discussed the venue for the next World Buffalo Congress to be held in 2010. Europe was excluded for the principle of the rotation of continents. 2010 was the turn of American continent. Argentina, that was candidate since 2004, has been presented his candidature to host the next congress by the representative member Marco Zava, who sent to the Secretary and distributed documents of interesting and engagement by following institutions: Asociacion Argentina de Criadores de Bufalos, Ministerio de la Producciòn de la Provincia de Formosa, Governator Provincia de Corrientes, Secreteria de Agricoltura, Ganaderia, Pesca y Alimentos in Buenos Aires, Ministerio de Economia y Producciòn in Buenos Aires, Universidad Nacional de Nordeste and Universidad Nacional de Formosa.
Thailand also presented his candidature to host the Congress, by the representative member Rangsun Parnpai, in the name of Maneewan Kamonpatana, IBF founder member since 1985, who was enable to participate for a cerebral haemorrhage, but wrote a letter about the will to host the congress. A booklet with the Organizing Committee and provisory programme was distributed.

The General Secretary expressed his pleasure for the two prestigious candidatures, underlining the growth of the IBF, not only for number of members and countries, but for the passion and enthusiasm devoted to the different activities.
There was a vivacious discussion on the candidatures, until Ragsun Parnpai, at the moment of vote, renounced to his candidature and decided to support the Argentina proposal, requiring support from all the countries to held the 10th World Buffalo Congress in 2013 in Thailand, to avoid the vote that could provoke a division between Asian and American people.
Therefore Argentina was elected with unanimous vote as the country organizing the 9th World Buffalo Congress in 2010.
Marco Zava proposed as IBF President Federico Romero, the President of the Argentina Buffalo Breeders Association.
Federico Romero was elected with unanimous vote as IBF President for the period 2007-2010.
Jesus Reggeti proposed Ricardo Botero as Vice-President for Americas in place of Marco Zava.
Ricardo Botero was elected with unanimous vote as Vice-President for Americas.
The dates of other congresses were established to avoid the coincidence with the World Buffalo Congress: the third Buffalo Symposium of Europe and the Americas will be held in Venezuela on October 2008, the 6th Asian Buffalo Congress will be held in Lahore, Pakistan on October 27-30, 2009 by the President of Asian Buffalo Association, Talat Naseer Pasha.
The Past President Zicarelli thanked the representative members and the participants to the congress, congratulated with the elected President Romero, who thanked for the trust, assured his care and delegated Marco Zava as President of the Organizing Committee and of the Scientific Committee, inviting all delegates of different countries to collaborate. After that, a tourist video on Argentina was presented.

Antonio Borghese

VIII WORLD BUFFALO CONGRESS

Caserta, Italy, 19-22 October 2007

Hotel Crowne Plaza - Congress Centre

REPORT

From October, 19th to 22nd, in the Convention Center of the Crowne Plaza Hotel of Caserta, the VIII World Buffalo Congress was held, with the assistance of more than 400 persons from 39 countries of the 5 continents. More than 400 papers were presented in 4 simultaneous sessions during 4 days.
The **countries participants** were Italy, Canada, United States, Argentina, Trinidad, Venezuela, Colombia, Cuba, England, Scotland, Wales, Australia, New Zealand, Brazil, Thailand, Vietnam, Iran, Iraq, Japan, Turkey, Bulgaria, Bangladesh, Pakistan, India, Sri Lanka, Philippines, Germany, Holland, China, Egypt, Nepal, France, South Korea, Sweden, Belgium, Spain, Mozambico, Uruguay and Costa Rica.
The Congress included on the day October, 21th, an **Italian Breeders National Meeting**, attended by 650 Italian producers from all the regions of the country, fact that occurs for the first time in Italy with such a success, because the presentations, in Italian language, were related to national and local problems, and to management aspects, and all this was of direct interest for the businessmen of that country. In few words, a brilliant idea.
The **argentine delegation** was integrated by some breeders and directors of the AACB, the Argentinian breeders association (J.P. Nelson, A. Rozenblum, F. Romero, R. Maglietti, M. Breard and M. Zava), some technicians of the UNNE, the University of Corrientes (Drs. G. Crudeli and E. Patiño), a director of International Congresses S.A. (Mrs. M. Lentino) and a representative of the argentine Government (C. Feeney).
The papers presented at the Congress had, in general, a very good scientific and technical level. They included several topics as Production Systems in the different regions, continents, and countries in the world (Invited Lectures), and also presentations related to Genetics, Nutrition and Feeding, Reproduction, Biotechnology, Infective diseases, Parasitic diseases, Clinical Training, Dairy Production, Feeding Security and Technology, Beef Production, Management, Breeding and Environment, and Economy.
Some presentations that were attended by who is writing this report will be now briefly commented.

Dr. Libertado Cruz (Former I.B.F. President and General Director of the Philippine Carabao Center, Philippines) comments that the increasing of the urban population and their higher level of consumption focused the demand to a higher preference for beef and dairy meals.
The world supply of these products has been in troubles lately, specially both the European Union and the United States supplies (B.S.E., etc.). With the consequent increasing of world prices in beef and dairy products, and with the increasing of the prices of the cattle to import, in the long term there will be a great expansion of the bubaline livestock in Asia. In all the Asian countries is required an acceptable level in animal health, easier to reach with buffaloes in the Asiatic conditions. In 2004 Asia produced 2.886.000 tons. of meat (92,38 % of the total in the world). In India the male calves mortality decreased from 80 % (I saw it personally during my visits in the '80 decade) to the 7 %, because now they are fattening them for exports.

Dr. Talat Naseer Pasha (President of the Asian Buffalo Federation, and Dean of the Faculty of Business Management, University of Veterinary and Animal Sciences, Lahore, Pakistan) comments that in his country there are 30 to 35 million persons involved in buffalo industry. 38 billions liters are produced per year. From 1996 to 2006 the Pakistani buffalo population has increased in a 35 % (from 20,27 million heads to 27,34 million), becoming now the second population in the world.

Dr. Suked K. Ranjhan, President of the Indian Buffalo Breeders Association, Editor of the Asiatic Buffalo Journal, and

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Chairman of Hind Agro Industries (the biggest buffalo beef processor and exporting trading in India), considers that livestock is one of the principals resources to mitigate poverty and to improve life quality. The bubaline (96 million heads) and cattle (189 million) populations in India are the biggest populations in both species in the world. This country is the world's principal milk producer (96 million tons. in 2006).
In India only 15 % of the milk production is elaborated in dairy industrial plants.
India produces 1,421 million tons of meat per year. Actually there are 12 meat exporting industrial plants in the country. They purchase the male buffalo calves, and they also pay to the breeder it's feeding cost (some like $ 120,00 in total). In that way the farmers are stimulated to keep the calves. But now also the plants themselves are fattening buffalo calves. The Hind Livestock Development Foundation (HLDF) actually breeds and fatten 10.000 buffalo calves per year. And they slaughter from 1000 to 1500 fat buffaloes per day.

Antonio Borghese, Morten Dam Rasmussen and Santosh Thomas presented a new book, edited by the International Dairy Federation, on "Milking management of dairy buffaloes", where the problems about milk ejection physiology, buffaloes milkability, milk recording, quality and storage, milking machines and routines and udder health are discussed

Ing. Zoot. Jesús Alberto Reggeti Gómez (Former President of the Venezuelan Buffalo Breeders Association and Director of Terecay Ranch, San Fernando de Apure, Venezuela) described aspects of buffalo breeding in his country. Actually there are nearly 7000 buffalo farms in Venezuela. A great number of breeders turned to dairy. There are 320.000 buffaloes in the country. 60 % of the buffaloes have double aptitude, for beef and dairy production. 68,9 % of the bubaline diet are natural pastures. The buffaloes are mainly located in the plains region with floodable lowlands. The productions given to the country by the buffalo are: beef, milk and draught. The annual buffalo milk production reaches 13 million liters.

Dr. Octavio Bernardes (Former President of the Brazilian Buffalo Breeders Association, and owner of Paineiras da Ingaí, a top level farm in Murrah genetics and dairy production) estimates that actually the buffalo population in Brazil reaches at least 3,5 million heads: 69 % Murrah and it's crosses, 20 % Mediterranean, 8 % Jafarabadi, 2 % Brazilian (dehorned animals), 1 % crosses and 0 % Carabao or Swamp Buffalo (very few remaining). This population is distributed in 25.000 herds. 62 % of the buffaloes are located in the Amazonic region (Northern Brazil), 9 % in North East, 6 % in Central West region, 10 % in South East, and 12 % in Southern Region. The bubaline beef production in Brazil is increasing: in 2006, 744.000 buffaloes were slaughtered, producing 155.000 tons. of meat.
Milk productions per lactation have a significant variability. In extensive production systems, with one milking per day (most numerous of cases) the average is 1460 liters. With two milking, 2500 liters. and adding genetics, 3000 liters. Individual productions differs from 900 to 5142 liters. 92 million liters are produced per year by 82000 buffalo dairy cows of 2500 herds. Nowadays 150 dairy industrial plants are processing buffalo milk.

Dr. Pietro Sampaio Baruselli (Director of the Animal Reproduction Department, Faculty of Veterinary Medicine and of Zootecnia, University of Sao Paulo, Brazil) in his presentation related to buffalo reproduction technologies comments that he observed a minor ovulation in buffalo heifers compared to adult buffalo females. He reports that now is possible to control the heat in the female through techniques that control the follicular waves dynamics and the ovulation. This allows an efficiency in heat control superior to the utilization of vasectomized males. But heat control only with prostaglandin is difficult, so that is necessary to apply in females the treatment known as "OVSYNCH protocol". This protocol can be defined as a fixed time artificial insemination scheme, with ovulation's synchronization in buffalo cows during the favorable reproductive season.

Dr. Giuseppe Campanile (University Federico II of Naples, Italy) considers that the bubalines are a "photoperiodic species" (related to the fact that light decreasing induces to heat), but adding that this fact

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depends on the distance from equator line. According to Italian experience, since when the season begins to be changed in buffalo mating, it takes three years the milk production to supply the demand during the whole year. The difficulty in the out-season mating, that means mating during the increase of light period, the anestrous days reach to 100-120, instead of the normal 50-60 days.

Dr. Luigi Zicarelli (the I.B.F. President and Dean of Faculty of Veterinary, University Federico II of Naples, Italy) comments that in his country, from 1975 to 2007, the first calving age decreased to 36 months. He says that it would be less without the out of season mating.. The intercalving periods are longer in the spring calving (out of season). In Italian conditions, high temperatures (with water pools) and feeding (always correct) does not have great influence in intercalving period. He considers the light stimulation as the principal factor in Italy.

Dr. William Gomes Vale (Federal Rural University of Amazonia, Pará, Brazil) comments that the Bubalus bubalis sp., in spite of being considered since long time ago as a seasonal poliestric animal of short light period, without any doubt, in tropical areas near to equator line is a continuous (yearly) poliestric animal. In those areas the calving season is regulated by the natural pastures availability.

Dr. Kate Neath (graduated in the Sidney University (Australia), and on charge of the Animal Science Doctoral Program of the University of Tsukuba, Japan) presented the results of an evaluation realized in Philippines, with Dr. Libertado Cruz and collaborators.
It is related to the protease "post-mortem" activity on the tenderness of buffalo beef and cattle beef. During the "post-mortem" first occurs the "rigor mortis" and then the proteolisis, which increases the tenderness. The buffalo meat (an F1 cross animal, Murrah x Swamp) was more tender than the cattle meat (a cross of Brahman with Philippine native cattle). The animals were supplied with correct feeding during 6 months before being slaughtered. This evaluation was done with females of 30 months of age and then was repeated with males of 24 months, with similar results. One hour after slaughter the carcasses went into cold store. The registrations were done in Japan. The optimum pH for the enzymatic activity is 7,5. That means, for the protease activity, which resulted higher in the buffalo meat. Consequently, the proteolisis is higher and also is higher the tenderness. To optimize the cattle meat tenderness the ideal is to have two weeks of ageing. With buffalo carcass is enough one week to have a good tenderness, and with two weeks of ageing the higher iron level in buffalo meat possibly produces in it a higher oxidation. The slaughter age must be shorted to increase tenderness.

Ing. Marco Zava, Executive Director,
Argentine Buffalo Breeders Association

BUFFALO TOUR THROUGH ITALY

From October 23rd to 27th, in a 60 persons group of nearly 20 countries, we crossed Italy from Naples to close to Milan, in a very interesting tour, visiting farms and industrial plants, both for dairy and beef.

On October 23rd we left Caserta to visit the Foro Boario (a former livestock market), at Eboli, Salerno province (Campania Region), where the **3rd National Show of the Italian Mediterranean Buffalo** was taking place. After attending to the judgment of different and complex categories of buffalo males and females, work done by Doctor Massimo Neri, we had a lunch, including buffalo barbecue, mozzarella cheese and local red wines.
The principals championships were obtained by Morese S.S. (Salerno), Cecilia Baratta and Bellelli Heirs (Salerno), ALDES S.R.L. (Salerno), María Castigliego (Puglia), and Buphania S.R.L. (Salerno). Also the best

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Italian breeders were chosen: 1st: Morese S.S. (Salerno); 2nd: Verdesca delle Fiocche (Salerno); 3rd: Cecilia Baratta and Bellelli Heirs (Salerno); 4th: Garofalo Brothers and Sons (Caserta).

We began the second tour day, October 24th, visiting **Sant'Agnello Farm**, located in Caserta province, owned by Garofalo family. They bought four farms from 1950 to 2000.

And this farm, the last to be purchased, was built with the last technologies, and they are still finishing the last details. Dr. Raffaele Garofalo, one of the owners, told us that they have there 2000 heads, including 750 milking buffalo cows, producing more than 7000 liters per day. They have already built three milking parlours, and they are finishing one more. In a future they will arrive to 12000 daily liters with 1200 – 1300 milking buffalo cows. Calves remain one day with the mother, receiving the colostrum. They breed buffalo calves with automatic machines that identifies the animals through microchips, supplying the necessary feeding for each calve. The buffalo calves begin receiving daily 8 rations, then this number decreases, and finally are weaned with 13 weeks of age. Mortality is near 3 to 5 %. With two milking per day they obtain an average production of 2650 liters per lactation of 270 days long. Each parlour, with 24 milking machines, has a 1,8 % slope to permit their washing twice a day, and the faeces management: solid is separated from liquid.

They inseminate in November, December and January. And after that they use buffalo bulls for mating. They identify the calves and sires through DNA. In 2006, 400 A.I. were realized, with 40 % of pregnancy, making only one synchronized insemination. The buffalo bulls are retired on September, and turned back on March. Non pregnant females are identified for insemination. 55 % of calving occurs during summer (June to September) and 45 % in the rest of the year. With the out of season breeding 30 % of calving is lost. But in a herd of well fed young females the lost is smaller and 80 % of calving can be achieved.

Milking buffalo cows are supplied with rye grass, alfalfa, oats, corn silage, and concentrates that changes according to the gestation phase. Each group of 48 (multiple of 24) females in the same phase and 2 males, have access to a wallowing pool. Dairy buffalo cows producing 3500 liters or more are left till death. There are individuals of 4800 liters. The dairy buffalo cows have a bed of straw, that is daily added, and totally changed each 3 months. The water coming from the parlour washing goes to the "stocking pools", from where is taken for irrigation and fertilization through underground pipes and pumping. Solid faeces are separated through two "separating cigars", remaining with 70 % of humidity. They are used for bed and for fertilizing the fields during spring, improving the soils structure.

All this investments and facilities are justified by the high value of the land (€ 70.000 per hectare), and by a market of high consumption. The **Buffalo Beef S.A. Farm**, of the same owners, is located few kilometers far from Sant'Agnello. Is an agro-industrial farm, focused to buffalo beef production and processing. They have in the farm a cold meat industrial plant ("salumificio"). They breed buffalo calves from 45 to 430 kilos (215 kilos the carcass), with 14-15 months of age, and at that moment they slaughter them. They have 1500 heads, supplied with corn silage, straw and concentrates.

The next visit was to **Torre Lupara Farm**, in Pastorano, Caserta province (Campania Region): 170 hectares, owned by Alfredo and Cesare Jemma, who were waiting for us, together to Alfredo Junior. With only 8 workers and two daily milking they produce 12000 liters per day in winter and 18000 in summer (they do out of season mating), with 4,8 % of protein. They elaborate the "mozzarella" both mechanically and hand –made. They don't pasteurize, looking to increase the cheese yield. The cheese first is stocked in brine basins (10 % of salt) during at least 2 hours, and then in what they call "government liquid" (1 % of salt with lactic acid alone or including a 50 % of citric acid). They export to United States, Canada, Norway, etc., in a vacuum packaging or frozen. The vacuum allows a stock of 35 days, and the frozen, one year and a half. This was my third visit to Torre Lupara (I went in 1981 and in 1988, both times coming back from India), and is the third Jemma family generation I know. I can say I've learned a lot with them. They produce all the forage and food they need,

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except minerals. They have 1450 heads, including 520 milking and 160 dry buffalo cows. Each group of animals has it's land pen (better than cement for the animal's hoofs) and wallowing pools. We saw a spectacular heifer group, inseminated with OVSYNCH protocol, with a 60 % of pregnancy (I find it excellent for buffalo heifers). Faeces are collected from the pens to the pools, and then to tanks, where they separate solids from liquids. We left Campania region going to north, arriving to the town of Pofi, in Frosinone province (Lazio region), where we visited the fantastic **Pofi Prehistoric Museum**, guided by his Director, Prof. Italo Biddittu, an eminence in the subject, who "opened a little window" to us of all the acknowledgements of the human and animal origins, including buffaloes. We arrived to **Frosinone** for dinner.

In the next day, October 25th we went to **Latina province** (in Lazio Region), that has 40.000 buffaloes. Originally Latina had mainly swamp lands, now completly drained and converted in excellent agricultural soils. After visiting **Fossanova Abbey**, where lived and worked Saint Thomas of Aquino, we moved few kilometers to arrive to the **Farm of Gianni Martino** and his family. They produce milk and beef in 100 hectares with 800 buffaloes, including 250 milking buffalo cows producing an average of 12 liters per day (and a maximum of 25 liters) with 270 days lactations. They produce from 3000 to 3200 liters per lactation. They fatten males, slaughtering them with 450 kilos and 17-20 months of age. Daily ration for dairy buffalo cows consists in 20 kilos of corn silage, 6 kilos of hay, and 8 kilos of concentrate (called "unifeed"). In total 34 kilos per day. They stock alfalfa and rye grass hay. They cut green forage or hay, depending on the season. They have their own cheese-making. In Latina too, we visited a cheese factory, the **"Caseificio Maina Della Torre"**. They process the milk once a day. With milk, enzymes and whey as inputs, they make the curds. After 4-5 hours the curd is cut up very thin, and introduced in a wood tub with boiling water at 98 ° C, for the spinning process, where the spinned mass reaches 66-67 ° C. All the process is hand-made. They elaborate 36 to 40 kilos in each cooking, with a 25 % of yield. On October 26th. we went across **Frosinone province**, that with its 20.000 buffaloes maintains a long buffalo dairy tradition, with productions near to 2000 liters as an average, in 270 days, with 7 % of Fat and 4,8 % of Protein. In Frosinone, we visited **Amaseno District**, where there are 12.000 bubaline heads within a radius of 2 kilometers, on the sides of one hill. This farmers own approximately 60 buffaloes and 2 hectares each one. They buy all the forage and concentrates. Their milk goes mainly to Caserta, and also to a local little cooperative cheese factory. Only the **Salvatore Rinna Farm**, in Amaseno, has 30 hectares and 350 buffaloes, usually with 200 milking females. We had lunch in a wonderful restaurant near to **Orvieto City** (north of Rome), and we arrived for dinner to **Devezzano, in the coast of Garda Lake** (northern Italy).

We began our last tour day, October 27th, visiting the **Cremona International Fair** (Lombardía Region), huge, impressing, occupying several covered squares, visited by people of many countries, focused to dairy cattle industry, and also to dairy bubaline activity. This Fair includes a very important Dairy Cattle Show, which included in 2007 for the first time the participation of buffaloes through the **"Mediterranean Buffalo Meeting"**, organized by the Italian Buffalo Breeders Association (ANASB). We were able to appreciate a great supply of inputs, machinery and facilities for the bubaline dairy industry. We attended to the **Mediterranean Buffalo Show**, where we saw fantastic products of Massari (who presented a heifer daughter of a buffalo cow that produces 5800 liters, with 8 % of Fat and 4,3 % of Protein) and Ambroggi Farms. Then we participated to **a regional products tasting** at the Lombardia Region Stand. After the Fair, I personally could visit **COFA S.A. Artificial Insemination Center**, in Cremona province, where there are Mediterranean top level sires in semen production, under strict international sanitarian conditions. They process the semen, control it's quality, and they supply the italian market, and also export to many countries in the world. Then I met again the group, visiting the **Facchi Farm**, also in Cremona province (Lombardia Region). They have 1150 buffaloes, milking 400 females, with 1900 liters produced in 230 days of lactation. The milk goes directly

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from the cold tank to the cheese factory (in the same building). They consider that with a pH = 5 the milk is ready for the spinning process, all hand-made. This farm is totally integrated in its different productive processes, unique one in Italy. They have three destinations for the buffaloes: 1) Milk (cheese); 2) Beef (Males); and 3) Bio-Gas.
The Bio-Gas: They destiny the faeces to the transformation in solid (manure) and liquid, to obtain energy from them. The sources for Bio-Gas can be three:
a) Manure; b) Fibers; c) Dead animals (previous autoclave). The Bio-Gas production is destined in a 10 % to the farm consumption and in a 90 % to be sold as energy. It can be used as energy, or to dry fruits, or for heating. Just to have an idea, the production is enough to heat 250 medium apartments. The selling price is of € 0,15 to € 0,18 per Kilowatt. And they produce one megawatt per hour, with two engines with a total power of 1200 megawatts. They invested € 3,5 millions, financed with a 10 years credit. This project pays itself in three years.

Ing. Marco Zava, Executive Director,
Argentine Buffalo Breeders Association

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ROLE OF DAIRY BUFFALO IN EGYPT FOOD SECURITY

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INTRODUCTION

The milk and dairy imported products of Egypt had jumped from around 195 million dollars in 1990 to more than 422 millions in 2005, *(Table 1)*. The bulk of imports value has recently become as powder milk (65% of 2005 imports value). This is because the price of the reconstituted skim powder milk has being for a long time much cheaper than the domestic produced raw milk. Although milk production volume has almost doubled over the period (1990-2005), as shown in Table 2 the self-sufficiency in milk has stayed around 80%. On the other hand, red meat imports have risen significantly over the last two decades *(Table 3)*. Its value was 270 million dollars in 1990 and raised to 309 in 2005, the bulk was imported as either carcass, or boneless meat, *(Table 4)*. Although red meat production increased from about 410 thousand tons in 1990 to more than 692 thousand tons in 2005 at annual growth rate 3,3% *(Table 5)*, self sufficiency of Egypt in red meat has not increased significantly, i.e. from around 77% to 81% along the same period. (1990-2005). Although animal protein is a vital nutrient in daily diet, particularly for vulnerable groups (pre-school Childs, pregnant and lactating women), it has not reached the recommended percentage in Egyptian daily diet, i.e. one third of gross protein intake *(Soliman & Eid, 1995)*. The average per capita annual consumption of milk and meat reached almost one third of the world average. The average per capita consumption of milk increased from 45 kilograms in 1990 to almost 55kilograms in 2005, at annual growth rate 1.3% *(Table 2)*. At the same growth rate the average per capita consumption of red meat increased from 9.5kilograms to 11.7 kilograms during the same period, *(Table 5)*.

From estimated demand and supply model for red meat and milk markets in Egypt a recent study *(Ibrahim Soliman, 2007a)* has shown that the milk price at the end of this 5 years plan would reach 3 folds its current price. While the milk price would increase from $0.55 per kilogram to $1.34 kilogram in 2012, the red meat price would increase from $6.5 to $9.3 during the same period. Therefore, this study investigate the potential economic role of Egyptian buffalo in raising per capita consumption of meat and milk based upon domestic production and monitoring the price inflation of both commodities in the Egyptian market.

BUFFALO ROLE IN MILK AND MEAT PRODUCTION

Buffalo Stock in Egypt increased from 2898 thousand heads in 1990 to about 3920 thousand heads in 2005 at an annual growth rate of 2.2%. Producible units of such population are the milking heads. Their numbers increased from 1330 thousand heads in 1990 to about 1640 thousand heads in 2005 at an annual growth rate of 2.2% *(CAPMAS, 2007)*. Such buffaloes population shared by about 54.5% of milk production which was about 2292 thousand tons in 1990. This share increased to 56% of 4103 thousand tons in 2005. The annual increase rate in buffalo milk production was about 3.8%, *(Table 6)*, which was the highest rate among other types of livestock producing milk in Egypt. The major share of buffalo milk in total milk production of Egypt is actually much higher than apparent one. This is because of two reasons. First, most, if not all, milk production of sheep and goats are devoted to rearing suckling lambs and kids, *(James Fitch, Ibrahim Soliman, 1983)* Secondly, readjustment of buffalo yield as milk equivalent of on 4% fat, to be comparable to cow milk, would raise buffalo milk volume by almost 70%, by using "Jane's Equation", *(Ibrahim Soliman and Ahmed Mashhour, 2002).*

With respect to meat, buffalo share in total production has stayed around 39% along the last two decades, *(Table 7)*, even though its production volume increased from 161 thousand tons in 1990 to more than 270 thousand tons in 2005, at an annual growth rate of 3.2%. Cattle meat production

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Table 1. **Egypt Milk Imports Value $(000) over the period (1990-2005).**

Year	Value	Powder Milk	Full cream milk	Cheese	Yoghourt	Casein	Total	Milk fat products	Grand total
1990	(000) $	37,615	276	43,903	1	445	82,242	112,300	194,542
	%	45.74%	0.34%	53.38%	0.00%	0.54%	100.00%	57.73%	100%
2005	(000) $	104,384	306	51,861	22	4,482	161,055	260,708	421,763
	%	64.81%	0.19%	32.20%	0.01%	2.78%	100.0%	61.81%	100%

Table 2. **Self Sufficiency in Milk of Egypt over the Period (1990-2005).**

Year	Value	Production	Imports	Available	Export	Other Uses(1)	Net Consumption	Per capita consumption (kg)
1990	(000) tons	2292	721	3012	27	501	2485	45.07
	%	76.10%	23.90%	100.00%	0.90%	16.60%	82.50%	
2005	(000) tons	4103	956	5059	159	883	4017	55.14
	%	81.10%	18.90%	100.00%	3.10%	17.50%	79.40%	
Annual Growth rate (%)		3.6%	1.8%	3.2%	11.1%	3.5%	3.0%	1.3%

(1) It is the sum of wastes and milk used for suckling.

Table 3. **Self Sufficiency in Red Meat of Egypt over the Period (1990-2005).**

Year	Value	Total Red Meat Production	Imports	Total Supply	Total Exports	Net Consumption
1990	Tons	410,045	122,014	532,059	6,854	525,206
	%	77.1%	22.9%	100.0%	1.3%	98.7%
2005	Tons	692,505	158,980	851,485	2,619	848,865
	%	81.3%	18.7%	100.0%	0.3%	99.7 %

Table 4. **Egypt Red Meat Imports Value $(000) over the period (1990-2005).**

Year	Value	Total Carcass, Boneless and Processed meat	Total live animals	Grand total of Imported red meat
1990	$ (000)	263,298	7,203	270,501
	%	97.3%	2.7%	100.0%
2005	$ (000)	300,149	8,977	309,126
	%	97.1%	2.9%	100.0%
Annual Growth Rate	%	0.8%	1.4%	0.8%

Source: Calculated from: Statistical Data Base of Internet Site (www.fao.org)

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Table 5. **Self Sufficiency in Red Meat of Egypt over the Period (1990-2005).**

Year	Value	Total Red Meat Production	Imports	Total Supply	Total Exports	Net Consumption	Per Capita (kg)
1990	Tons	410,045	122,014	532,059	6,854	525,206	9.5
	%	77.10%	22.90%	100.00%	1.30%	98.70%	
2005	Tons	692,505	158,980	851,485	2,619	848,865	11.7
	%	81.30%	18.70%	100.00%	0.30%	99.70%	
Annual Growth	%	3.3%	1.7%	2.9%	-6.0%	3.0%	1.3%

Table 6. **Milk production in Egypt in (000) Tons.**

Year	Value	Buffaloes	Cows	Goats	Sheep	Total
1990	(000) tons	1250	974	15	53	2292
	%	54.5%	42.5%	0.7%	2.3%	100.0%
2005	(000) tons	2,300	1,695	15	93	4,103
	%	56.0%	41.3%	0.4%	2.3%	100.0%
Annual Growth rate (%)		3.8%	3.5%	0.0	-3.6%	3.6%

Table 7. **Red Meat production in Egypt in (000) Tons.**

Year	Value	Buffalo Meat	Camel Meat	Cattle Meat	Sheep Meat	Goat Meat	Total Red Meat Production
1990	(000) tons	161	22	143	55	28	408
	%	39.3%	5.4%	34.9%	13.3%	6.7%	100.0%
2005	(000) tons	270	40	320	43	18	691
	%	39.0%	5.8%	46.2% %	6.1%	2.6%	100.0%
Annual Growth rate (%)		3.2%	3.7%	5.0% %	-1.6%	-2.6%	3.3%

Source: Calculated from: Statistical Data Base of Internet Site (www.fao.org)

has the highest share in the recent years, *(Table 7)*.

FOOD SECURITY OF EGYPT AND ECONOMIC CONCEPTS

The Egyptian Economy, particularly agricultural sector, has passed dramatic changes towards free market economy over the last two decades. Such reform policies include liberalization of both input and output prices as well as foreign exchange rates of local currency and interest rate, besides privatization of almost all production sectors, *(Ibrahim Soliman,1991)*. Such changes implies reallocation of limited agricultural resourses on base of the best economic alternative use. Egyptian agriculture is almost fully surface irrigated by limited quota of river Nile water and little sub-ground water. The rained agricultural land is rare. There are high competition among human food and industrial crops with

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fodders and feeds on such limited land and water resources. Therefore, feeds and fodders domestically produced are relatively expensive in comparison with extensive rained agricultural systems in many other countries *(Ibrahim Soliman, 2007b)* Accordingly, Egypt should concentrate on only one or two types of animals that would have the most economic performance with respect to milk and meat production within the Nile valley agricultural acreage. The two candidate animals are Buffaloes and Cattle.

EGYPT COMPARATIVE ADVANTAGE IN MILK AND MEAT PRODUCTION

Comparative advantage is the economic principal for allocation of resources as the free market economy system is applied. It means to allocate resources for a set of products among all possible ones, where the resources perform the least disadvantages in terms of costs of production, *(Ibrahim Soliman, 1994).*
Among several indicators to estimate the comparative advantage is the "Nominal protection Coefficient (NPC)". Such coefficient is estimated from the following equation:

$$(NPC)_{ij} = P_{ij0}/P_{ija}$$

Where:
$(NPC)_{ij}$ = The nominal protection coefficient of the commodity (i) produced by resource j
P_{ij0} = Farm Price of the commodity (i) produced by resource j in the domestic (0)
P_{ija} = Farm Price of the commodity (i) produced by resource j in the alterative market (a)

Where in our model:
i = m for milk and r for red meat,
j = (b) for buffalo and (c) for cattle
The farm price is used as the closest one to the costs of production value. The data were extracted from (FSTAT), the statistical data base of FAO over the period 1990-2005. The domestic market is the Egyptian market and the alternative one that supposes to perform competitive conditions is the average world market. It is assumed that the aggregate average of the world market reflects the fair free competitive market conditions. Accordingly the judgment for the Egyptian market is concluded from the result of the following criteria:

If $(NPC)_{ij} \leq 1$ ~ Egypt has a comparative advantage in producing Commodity i by livestock type j, other wise it has not such advantage.

If cattle and buffaloes under Egyptian market conditions have shown comparative advantage performance in producing both commodities (milk and meat), another indicator should be used to judge which type of livestock should have the first priority in food security plan. Such indicator is presented by the following equation:

If $(NPC)_{bj} / (NPC)_{cj} \leq 1$ ~ buffalo production of commodity j (milk or meat) is more economical in utilizing resources under Egyptian market conditions.

Investigation of the results of calculating the nominal protection coefficient for milk and meat production in Egypt by buffalo and cattle, *(Table 8 and Table 9)* showed that Egypt has apparent comparative advantage in milk production from both types of livestock, because the estimated (NPC) was less than one in all concerned years. However, the estimated (NPC) for milk and meat produced by buffalo was less than that estimated for cattle in all investigated years (1990-2005). The estimated coefficient for buffaloes was not only less than that for cattle but it also decreased gradually over time at speeder rate than cattle. This result gives buffaloes more economic advantage in Egypt than cattle, along with further involvement of the Egyptian economy in free market system.
In lights of what shown above about the implication of comparative advantage, and results of *(Table 8 and Table 9)*, It showed that the nominal protection coefficient for milk production by buffalo was less than the estimated one for meat, particularly from the year 1994 until 2005.

PRIORITY IS FOR MILK IN BUFFALO DEVELOPMENT PLAN

The results showed that the average farm gate price of both milk and meat from buffalo was less than the average international market, but it was much lesser for milk than meat. Therefore, the development plan should focus upon raising buffalo milk productivity, particularly that

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Table 8. **Indicators of Egypt Comparative Advantage in Milk Production.**

Year	Buffalo Milk			Cow Milk			Buffalo / Cow
	Farm Price ($ / ton)		Nominal Protection	Farm Price ($ / ton)		Nominal Protection	
	Egypt	World		Egypt	World		
1991	337.79	368.65	0.92	334.61	383.71	0.87	1.05
1992	334.16	414.33	0.81	312.79	378.93	0.83	0.98
1993	344.52	874.56	0.39	313.50	445.57	0.70	0.56
1994	355.08	461.75	0.77	314.02	354.34	0.89	0.87
1995	383.23	550.07	0.70	316.61	395.83	0.80	0.87
1996	398.06	590.61	0.67	309.30	406.11	0.76	0.88
1997	398.38	643.77	0.62	309.55	411.39	0.75	0.82
1998	442.74	728.69	0.61	344.16	399.99	0.86	0.71
1999	441.79	813.82	0.54	343.42	395.29	0.87	0.62
2000	432.02	800.37	0.54	335.83	381.23	0.88	0.61
2001	402.72	805.36	0.50	312.86	377.99	0.83	0.60
2002	368.92	824.70	0.45	286.69	391.40	0.73	0.61
2003	316.19	1077.44	0.29	259.79	445.65	0.58	0.50
2004	326.59	1146.88	0.28	270.94	490.43	0.55	0.52
2005	363.56	1239.52	0.29	304.29	515.58	0.59	0.50

Table 9. **Indicators of Egypt Comparative Advantage in Meat Production.**

Year	Buffalo Meat			Cow Meat			Buffalo / Cow
	Farm Price ($ / ton)		NPC	Farm Price ($ / ton)		NPC	
	Egypt	World Average		Egypt	World Average		
1991	2263.86	2631.73	0.86	2333.33	3032.97	0.77	1.12
1992	2197.64	3012.92	0.73	2257.85	2908.69	0.78	0.94
1993	2647.86	3205.30	0.83	2350.17	2887.81	0.81	1.02
1994	2782.76	3185.91	0.87	2383.95	2569.11	0.93	0.94
1995	2928.77	3580.93	0.82	2626.61	2869.79	0.92	0.89
1996	3087.15	3718.61	0.83	2703.83	2854.89	0.95	0.88
1997	3083.73	3452.89	0.89	2773.88	2720.41	1.02	0.88
1998	3019.48	3462.25	0.87	2780.40	2684.90	1.04	0.84
1999	3163.24	3990.13	0.79	2736.18	2729.14	1.00	0.79
2000	3335.21	3913.60	0.85	2911.82	2614.83	1.11	0.77
2001	2937.33	3848.48	0.76	2975.08	2643.33	1.13	0.68
2002	3381.36	3811.63	0.89	3015.78	2786.91	1.08	0.82
2003	2998.70	4737.41	0.63	2678.23	3137.42	0.85	0.74
2004	3213.48	5093.18	0.63	2873.11	3473.73	0.83	0.76
2005	3733.39	5449.09	0.69	3258.37	3736.11	0.87	0.79

Source: Calculated from: Statistical Data Base of Internet Site (www.fao.org)

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Table 10. **Trend of Buffalo Milk Productivity: Egypt versus World Average.**

Year	Kilogram of milk Per Milking Head		
	Egypt Average	World Average	Egypt / World
1990	940	1115	0.843
1991	957	1116	0.857
1992	970	1150	0.8437
1993	1032	1187	0.8699
1994	1039	1213	0.8564
1995	997	1285	0.7758
1996	1203	1316	0.9138
1997	1340	1346	0.9954
1998	1340	1351	0.9921
1999	1340	1406	0.9532
2000	1340	1426	0.9396
2001	1349	1438	0.9381
2002	1273	1447	0.8798
2003	1603	1489	1.0767
2004	1400	1497	0.935
2005	1402	1506	0.9311
2006	1402	1537	0.9127
Annual Growth rate (%)	2.5%	2.0%	

Source: Calculated from: Statistical Data Base of Internet Site (www.fao.org)

milk price projection, as shown in the introduction, would reach 2.5 folds its current level due to speed demand increase and slow production growth.

Among the major targets towards raising milk productivity from the Egyptian buffaloes herd are the annual milk yield per milking head and the herd structure, particularly the proportion of milking herd in the stock. Although milk yield per milking buffalo has raised from 940 kilograms in 1990 to about 1402 in 2006, and at a higher annual growth rate of 2.5%, than the world average (2%), it was less than the comparable milk yield level of the world average. The world aggregate average reached only 1537 kilograms per milking buffalo in 2006, i.e. higher than the same year average of Egypt by 8.8%, *(Table 10), (Figure 1).*

Although the proportion of the milking buffaloes in the total herd of Egypt was significantly higher than the world average *(Table 11)* along the last two decades *(Figure 2)*, it has shown a rate of decrease by about -0.6% a year. In addition, the optimum milking heads proportion in total herd structure should be 50%, *(Mohammed Sharaf, Ibrahim Soliman & Aimed Seleem, 1987).* Accordingly, as the percentage of milking buffaloes in the Egyptian stock reached 42% in the year 2006, such

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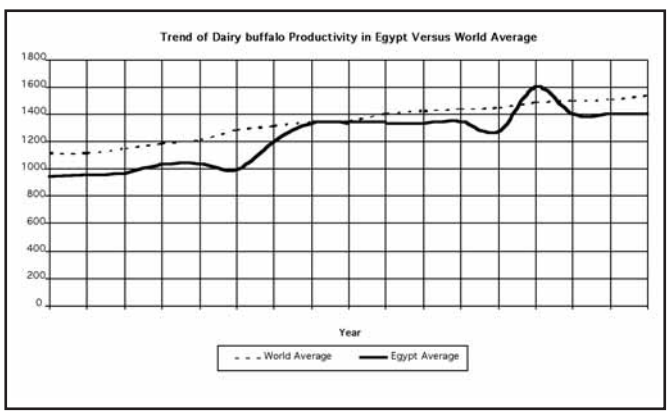
Table 11. % of Buffalo Milking Heads in Total Stock: Egypt versus World Average.

Year	% of Milking Heads		
	Egypt Average	World Average	Egypt / World
1990	46%	27%	1.72
1991	46%	26%	1.75
1992	46%	26%	1.77
1993	46%	26%	1.76
1994	47%	27%	1.76
1995	45%	27%	1.69
1996	46%	27%	1.70
1997	46%	28%	1.63
1998	48%	29%	1.67
1999	45%	28%	1.60
2000	45%	28%	1.58
2001	46%	29%	1.60
2002	46%	29%	1.59
2003	42%	29%	1.46
2004	42%	29%	1.43
2005	42%	30%	1.39
2006	42%	30%	1.41
Annual Growth rate (%)	-0.6%	0.7%	

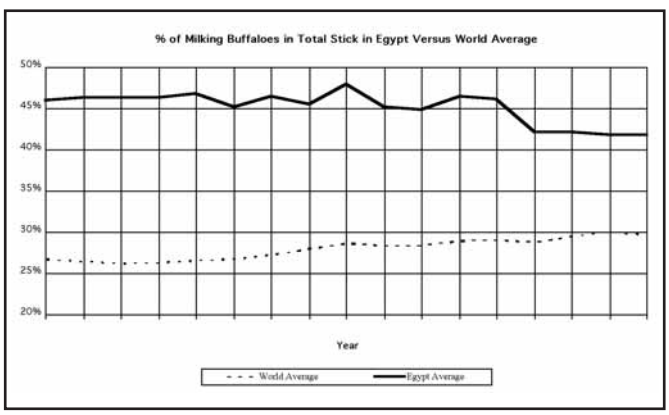
Source: Calculated from: Statistical Data Base of Internet Site (www.fao.org)

Figure 1. Trend of Buffalo Milk Productivity in Egypt versus World Average.



Source Table 10

Figure 2. Trend of % of Milking Heads in herd Structure in Egypt Versus World Average.



Source Table 11

percentage should be raised by 19% above its current level to approach 50%. Therefore, if the development plan oriented the credit policies, veterinary care programs and feeding plan of buffaloes towards reaching the target improvement of buffalo milk productivity, the total milk production of Egypt would be raised by about 29%, as calculated from the following equation.

$$r_{mp} = r_{mb} + r_{my}$$

Where:

r_{mp} = growth rate in national milk production

r_{mb} = growth in milking buffaloes number

r_{my} = growth in milk yield

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Such increase would raise milk production self-sufficiency of Egypt and shrink the speed of its price increase. There would be not only positive economic impacts but there would also be social impacts on nutritionally vulnerable groups by raising per capita consumption.

CAUDAL CONCLUSION

It should be mentioned that the study assumed in its analysis the aggregate average of the world market reflects the fair free competitive market conditions. However such assumptions are not fully true, either about free market conditions or the significance of the world average farm price. These because there are several markets may practice undetectable governmental interventions in the price mechanism. Also, there are several countries are not highly producible to be potentially effective in the international markets as those of high share in world production and world export market of either milk or meat, such as western Europe, America and Australia. Therefore, further study is going to repeat the estimates with limiting the comparison on base of the a few markets that have high significant share in world production and exports of both investigated commodities.

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THE BUFFALO, A SOCIAL ANIMAL FOR THE HUMANITY

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ABSTRACT

The history, domestication and diffusion of buffalo species in the world have been explained. The economic and social role of buffaloes reared in different Asian countries have been reported.

Key words: Asian Buffalo, social animal, production, perspectives.

INTRODUCTION

I think that old men only can appreciate the real value of buffalo. Old men with large experience of the history of buffalo in different continents and countries, how much this species contributed, contributes and will contribute in the family and social activities for the surviving and the prosperity of the people even if in primitive and poor conditions.
The domestication of buffalo *(Bubalus bubalis)* occurred relatively recently (5,000 years ago) compared to the domestication of the Bos taurus and Bos indicus (10,000 years ago). The domestication occurred in East Asia and the buffalo began a family animal, linked to the River culture that is associated to the agriculture products obtained with water, particular rice. So from the domestication, buffalo lived in the East Asian villages working in the rice-fields, producing milk, meat, skin and bone for the people needs.
The Buffalo, is the only truly native bovine of East Asia countries, is endowed with a unique and irreplaceable genetic legacy with regard to adaptation to the environment and local feed, resistance ,rusticity to diseases and to humid and hot climates. Therefore the buffalo began the basis of the water production systems, providing draught power in difficult conditions, being not possible the substitution with other species, neither with Indian Zebu ; until now, when the mechanization introduced in many East Asian countries too, is dangerously modifying the productive balance of the ecologic systems in the Continent.
We have to consider anyway the large biodiversity of buffalo species, particularly in Asia, that is a real richness, for the variety and the quantity of breeds, some of them described in the FAO book "Buffalo Production and Research" *(Borghese, 2005)*, some unknown until now.
Therefore we have to consider the buffalo species the most important biological, natural, genetic resource to be preserved to contribute more to the socio-economic, cultural and human development of the Asian Continent and of the other countries, where it was spread out, as Egypt, Italy and other European and South American countries.

BUFFALO HISTORY

Representations of tame, and hence possibly domesticated, buffaloes appear on seals both in the Indus valley (steatite seal from Mohenjo – Daro, showing male Swamp buffalo at a manger, indicating domesticated buffaloes by approximately 2,500 B.C.) and in Mesopotamia (Ur) from about the middle of the third millennium B.C.*(Cockrill, 1974)*. They have the typical crescentic horns of the wild and Swamp buffaloes *(Zeuner, 1963)*.
According to Shalash (1991) there is archeological evidence of buffalo domestication dating back to 2,500 B.C. in Mesopotamia and the Valley of Indus. In 1980 Sieh Chen-Hsia, however, reported about more recent archeological investigations in China (Chekiang Province) which give grounds to the assumption that the domestication of the buffalo has started 7,000 years ago *(Alexiev, 1998)*. Bhat (1992) believes this happened about 5,000 years ago on the Indian sub-continent, more precisely in the valley of Indus. According to him, the domestication of swamp buffaloes also took place in China indipendently about 1,000 years later. Also

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according to Epstein (1969), domesticated buffaloes were known in the second millennium B.C. in China and appear to have been introduced from the south. According to Dhanda (2006) all the buffaloes have been originated from Asia and domesticated about 5000 years ago in Indus valley. Wild asiatic buffaloes were found in or near Brahmaputra valley, West of Madhya Pradesh and Kosi Tappu in Nepal. At that time these animals were fulfilling wide spectrum of activities like carting, sports and entertainment, religious and social rituals besides being a status symbol. The area from east of Indus Valley to Mesopotamia was probably covered with thick forests transversed by several rivers and streams thus providing an excellent agro-climatic condition for domestication and multiplication of buffalo in this region *(Dhanda, 2006).*

The domestic buffalo was not recorded in ancient Judaea, Egypt, Greece or Rome and the first certain record of it in the Jordan valley was in 723 A.D. Apparently they were brought from Mesopotamia by the Arabs and may also have been taken by them to Egypt; Sidky (1951) says that they first appeared there after Arab conquest in the ninth century. They came to Europe in advance of the Muslims, but Zeuner (1963) follows Keller in discounting the tradition that they were introduced by the Mongol invaders. (The Lombard King Agilulf in Italy was supposed to have received them as a rare gift from the Khan of the Avers in Hungary at the end of the sixth century A.D.). Since buffaloes bred by Huns, Avaris and Longobards in the Danubian area and Pannonia were swamp, it is unlikely that they are those that gave origins to the present European populations; it is likely that the present river population derives from Mesopotamia and was introduced by Arabs in Egypt and subsequently, at the beginning of the 9th century in Sicily, Balcanian and Danubian areas *(Zicarelli, 2006).*

It seems more likely that buffaloes were brought back by returning Crusaders and it is certain that by the beginning of the thirteenth century they were found in large numbers in Thrace, Macedonia and other parts of Bulgaria *(Kaleff, 1942)*. From there they spread to the rest of the Danubian countries and to Italy where they were present in the Pontine marshes at the end of the thirteenth century (Ferrara,1964).

DIFFERENT BUFFALO SPECIES

The *Bubalus bubalis* belongs to the class Mammalia, subclass Ungulata, order Artiodactyla, suborder Ruminantia, family Bovidae, subfamily Bovinae, tribe Bovini, which includes the following three groups: Bovina (cattle), Bubalina and Syncerina. Syncerina includes only the species Syncerus caffer (the African buffalo). Bubalina (the Asian buffalo) includes three species: Bubalus depressicornis or Anoa which lives in Indonesia, Bubalus mindorensis which lives in the Philippines and Bubalus bubalis deriving from the domestication of the Bubalus arnee, the Indian wild buffalo.

The African buffalo (Syncerus caffer), with its regional sub species, native to the savanna and to the forest (Syncerus caffer brachjceros/ West Africa, Syncerus caffer aequinotialis / Central Africa, Syncerus caffer caffer / East Africa and Syncerus caffer nanus / Forest regions) is the only truly native bovine of the Africa Continent. The African buffalo therefore is endowed with an unique and irreplaceable genetic legacy with regard to adaptation to the environment, resistance to disease (in particular to animal trypanosomiasis), rusticity, dimensions, weight (the Brachyceros can exceed 800 kg). Even a superficial comparison with the Zebu and other bovine species bred in Africa is enough to reach this conclusion. The subspecies of West Africa, found untill recently throughout the Sudanese Sahel belt, is now at serious risk of extinction. Since the buffalo is a good – natured animal and adapts well to breeding in captivity, its domestication does not present any particular problems. The period necessary to rear domesticated animals in the required quantity and of the desired quality, can be further reduced using modern breeding and selection practices.

THE ASIAN BUFFALO

It is impossible to speak generally about Asian buffalo, that is not a definite animal, but a complex of different breeds, coming from Swamp and River subspecies that adapted themselves to a range of climates, altitudes and temperatures. But the Asian

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buffalo, anyway represents the clear, only irreplaceable power of the agriculture economy in the vast Asian continent and the link between families and land.
Now we are going to examine the social and economic role of buffalo in some Asian countries.

INDIA.
India has about 95 million animals which represents 56.5 percent of the world buffalo population. India is the first country in the world for number of buffaloes and milk production (about 134 million/tons). Moreover India has implemented national programmes such as the "green revolution" (to increase crop production for animals), the "white revolution" (to increase milk productivity and satisfy human needs for proteins) and finally the "red revolution" (to increase meat production and strengthen the meat industry), particularly with regard to buffalo.
India possesses the best River milk breeds in Asia e.g. Murrah, Nili-Ravi, Surti and Jaffarabadi, which originated from the north-western states of India and have a high potential for milk and fat production apart from their use as a work animal and as a supplementary stock for use as meat production *(Sethi, 2003)*.
Buffaloes are well adapted to a hot and hot humid climate and play a distinct role in the economy of farmers, which is primarily based on agricultural production systems. They provide high quality milk and meat and are a source of draught power for smallholders in countries of this region. In fact these animals are considered a financial asset since they serve as an insurance against the risk of crop failure due to natural calamities *(Dhanda, 2004)*.

CHINA.
According to statistical data *(FAO, 2003)*, the total number of buffaloes in China in 2003 was 22.759 million, the second largest population of buffalo in the world, representing 17.37 percent of the total bovine population in China.
China has a huge variety of buffalo genetic resources, unknown to most buffalo experts other than the Chinese. They are all of the Swamp type, with a long history of domestic livestock, and provide many products to the farmers.
Most buffalo breeds tolerate all ranges of temperature, from 0°C in the winter to 30°C and over in the summer. We can find buffaloes in the river planes, on fertile soils and paddy fields, on the mountains and along the saline seaside shores of the east sea. This adaptability to saline terrain and to mountain climates is link to the different breeds selected during the centuries.
Therefore we can consider China as a country very rich of buffalo genetic variability.
All buffaloes have long horns, a typical trait of the Swamp buffalo. The colour of the coat is grey, with varying intensities: from deep grey and blackish grey to brown, hoar and light grey. The majority of the breeds also have white spots either in the form of stripes on the breast or in the form of rings on the neck.
As for all Swamp buffaloes, Chinese buffaloes are used for draught, often as their only task.

PAKISTAN.
In Pakistan, the buffalo is the main dairy animal in the country. Out of the 22 million head of buffalo in Pakistan, 76 percent are found in the Punjab (24 percent in other provinces of the country: Sind, North West Frontier Provinces (NWFP), and Baluchistan. The Punjab supplies 73 percent of the total national milk production and 71 percent comes from buffaloes which are part of the traditional small mixed farming system which is integrated with crop production.
Generally, animals are fed on crop residues with some additional forage/fodder grown for this purpose. Hay and silage making does not exist, except to some extent for institutional herds. Concentrates are fed to those animals that are kept for the sale of milk. The government facilitates vaccination against contagious diseases at nominal costs. About 5-10 percent of breedable females are artificially inseminated while the rest are mated naturally with bulls of a good type. Credit facilities have also been made available to farmers for the purchase of milk yielding animals but on a limited scale *(Khan et al., 1999; Khan, 2000)*.

PHILIPPINES.
In the Philippines there are 3.3 million Carabao buffaloes, and they registered an average annual population growth rate of

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1,9% between 2001-2005 *(Cruz, 2006)*; 99 percent belong to small farmers that have limited resources, low income and little access to other economic opportunities.
The Carabao buffalo is of the Swamp type: its history is basically a history of small-hold land based agriculture, since for centuries the Carabao has played a major role in draft animal dependent farming, mainly in the production of major agricultural crops, such as rice, corn, sugarcane and coconut; in recent years however, developments as the expansion of irrigation facilities have had a significant impact on the use of draft Carabaos: intensified rice production became pronounced in irrigated areas and this led to increased utilization of small farm machineries, thus displacing significantly the utilization of draft animals for land preparation; the introduction of tractors in corn and sugarcane production areas had similar effects (*Cruz, 2006).*
The Carabao Development Programme is a massive programme started in 1993 to improve the native Swamp buffalo locally known as the Carabao to develop their meat, milk and draught potential. An elite herd of Riverine buffalo has now been established at the Philippine Carabao Center, Science City of Muñoz by importing about 3 000 Murrah buffaloes with pedigree performance records from Bulgaria. Each female crossbred when raised for milk can produce about 1 350 kg of milk per lactation *(Cruz, 2003)*. The crossbreeding of Bulgarian Murrah (producing 1 800 kg per lactation) with a Swamp population (producing 400 kg per lactation) obtained F1 with 1 100 kg and F2 with 1 350 kg mean production respectively.

VIETNAM.
Swamp buffaloes in Viet Nam are mainly raised by smallholder farmers with small herds (four to eight head) partly used for draught power and partly for meat. Traditional management dominates the buffalo production systems. Buffaloes play an important role in agriculture and in the life of Vietnamese farmers. They are the main source of draught power for land preparation and transportation in the rural areas, and supply a huge amount of fresh organic manure for cultivation. They are also well adapted to utilizing local feed resources, are economic to maintain, and a source of credit for the farmers. The main crop of Vietnam is rice, and sub-crops are maize, sweet potato, cassava, groundnut, soybean, sugarcane and vegetables. In the high land provinces, cassava is especially popular. Buffaloes are freely grazed on natural grassland, forests, at roadsides, canal banks, rice fields after harvesting, dikes, etc. The local buffaloes are of the Swamp type with a total population of nearly three million. In general, Vietnamese Swamp buffaloes have a small body size, a slow growth rate, late maturity, a long calving interval and a low milk yield, but are very well adapted to local ecological conditions and have good disease resistance. Murrah buffaloes were used to cross with female Swamp buffaloes.

SRI LANKA.
The estimated number of buffalo owners in Sri Lanka is around 100 000. However, hardly any of them are full time buffalo farmers. About 87 percent are crop producers, who rear buffaloes as an additional source of income. About 64 percent use buffaloes for draught purpose, 34 percent for milk and draught, while only 2 percent keep buffaloes purely for milk. Buffaloes are spread throughout the country, with high concentrations in certain areas due to particular farming systems and market and socio-cultural reasons. The average herd size is around 22.5 animals. However, this figure is heavily dependent on the agro-ecological zone. Larger herds with an average of 40 to 50 animals are found in rice-growing areas of the dry intermediate zone. Smaller herds with an average of six to eight animals are found in mid and low zones (Bandara, 2000).
The buffalo population has decreased from 0.89 million in 1981 to 0.75 million (-15.45 percent) in 1997.

BANGLADESH.
Bangladesh now has about 400 000 adult female buffaloes that are being used for draught or dairy purposes. These buffalo are found in the Bramhaputra-Jamuna flood plain of central Bangladesh, the Ganges-Meghna flood plain of southern Bangladesh and in institutional herds.
The occurrence of crossbred dairy buffaloes indicates that the genetic improvement programme has been operative and is still running. Husbandry and production

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systems for buffaloes vary depending on the topography and vegetation patterns of the country. Buffaloes are raised under an extensive system in the coastal and hilly areas where large-scale pasture land and enough green forage are available.
Buffaloes are raised under semi-intensive system on plain land and marshy land where there is limited pasture land.
Intensive system for buffalo production is not practiced anywhere in Bangladesh even for institutional herds.
These common practices are: no housing system, no artificial insemination system, no routine vaccination programme and no animal identification and record keeping system.
The staple food for buffaloes in Bangladesh is rice straw, which is an inadequate source of energy and protein. Sugar cane leaves, micro silage of sugar cane leaves, cassava leaves, road side grass, elephant grass, maize with corn cob and pineapple bran are also used as feeding stuffs *(Faruque, 2003)*.

THAILAND.
The number of buffaloes has decreased yearly and the present number is about 1.7 million and is tending to decrease gradually. Approximately 83 percent of Thailand's buffaloes live in the northeast where most agricultural production is under rain fed conditions. Thai buffaloes are genetically of the Swamp type. The majority (90-95 percent) are grey to black in colour, while the rest are white. Most buffaloes are raised by small farmers in the rural areas. The breeding units of buffalo per family possess on average five to ten head from which no economic profit is made. There are very few farms that possess up to 50 head of buffalo and manage the herd as a commercial undertaking where animals are fed good quality feed and are well supervised. Buffalo breeding under village conditions is generally done by random mating. In fact, during the plantation season the buffaloes are tied up and fed with rice straw for almost four months resulting in a lack of opportunity to be bred during the plantation period. The animals, males and females, are grazed together in the paddy fields after the harvesting season. Consequently, unplanned breeding occurs during the harvesting time when the villagers allow the buffaloes to graze together. It is obvious that in general, there is no recording system approach at the farmer level as on the government farms *(Ancharlie Na-Chiangmai, 2000)*.
A programme on genetic improvement of Swamp buffaloes for use as a dual purpose animal is in place.

INDONESIA.
The buffalo breeds have been classified as Swamp and River subspecies, and most of the Indonesian buffalo are included in the Swamp one that consists of many types and varieties of breeds. There are varieties of the Swamp breeds in many different localities with divergences in size, weight, colour, marking and horn dimension. The Swamp buffalo is generally considered to be a working animal, but it also has a considerable capacity for milk production. Swamp buffalo are used for draught power in most areas and for beef in the Java lowland areas and the Sumatra uplands . Spotted buffaloes are highly prized (and therefore they command high prices) to be sacrificed and consumed on special occasions such as marriage ceremonies.
Most of the rural buffaloes maintained by small farmers in Indonesia produce less than 1 000 kg of milk per lactation. However, the production of fresh milk in Indonesia has not increased greatly over recent years and the level of production in the latter part of the 1990s was insufficient to satisfy the fast growing demand for this commodity. Around 90 percent of Indonesia's fresh milk production comes from smallholder dairy farms. Some of the problems these smallholders face are lack of capital, low technology, deficiencies in management of animal health, and insufficient human resources. In addition in the case of beef cattle and buffalo, it is common practice to tether them by the roadside, and in such cases, feed is cut and carried to them. Alternatively, they may be herded to "waste" areas where they graze on crop residues, and feed supplements are rarely given in sufficient quantities, and during the non-productive period, it is thought that farmers do not give the animals supplementary feed.
A new pilot programme will be to producing F1 and backcross buffaloes from Swamp and Mediterranean Italian River buffalo.

MALAYSIA.
In 1998, the total population of buffaloes in

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Malaysia was about 170 000. They were mostly concentrated in the rice growing states of Kelantan, Terengganu, Kedah and Pahang in West Malaysia (60 percent). The Swamp buffalo is used for ploughing, harrowing and working in the rice fields. At the end of its working life, the Swamp buffalo is slaughtered and in this way accounts for about 16 percent of the current meat supply in Malaysia.
Over the past two decades, there has been an alarming decline in the buffalo population in Malaysia with an average rate of population decline of 1.2 percent per year. This decline had been attributed to the displacement of buffalo by machinery for draught power in the rice fields, a low reproduction rate and a high extraction rate. Most farmers in rice growing areas discontinued the rearing of buffaloes due not only to labour shortages, but also to the limited availability of grazing land.

CONCLUSIONS

Therefore the Asian buffalo hold a real role as a social and family animal in the over described countries, living and working with the family and the children *(fig. 1, 2)* as a house animal, but producing too few quantities of milk and sometime meat.
The risk is that this useful type of animal will disappear as many countries are going to apply different social-economical changes:

1, Holsteinizzation, that means the substitution of draught animal with the Holstein Friesian to increase the milk production. This is a tragic mistake because the last one is coming from cold climate, suffering in humid and hot areas, extremely selected and delicate, with low active immunological system, with very reduced productive life.
2, Mechanisation, that means the introduction of more and more tractors, that could upset the traditional systems based on a sustainable agriculture.
3. Crossbreeding, that means the substitution of traditional draught breeds, Swamp type, of rice fields areas with selected breeds, River type, to increase the production of the milk and of the cheese industry.

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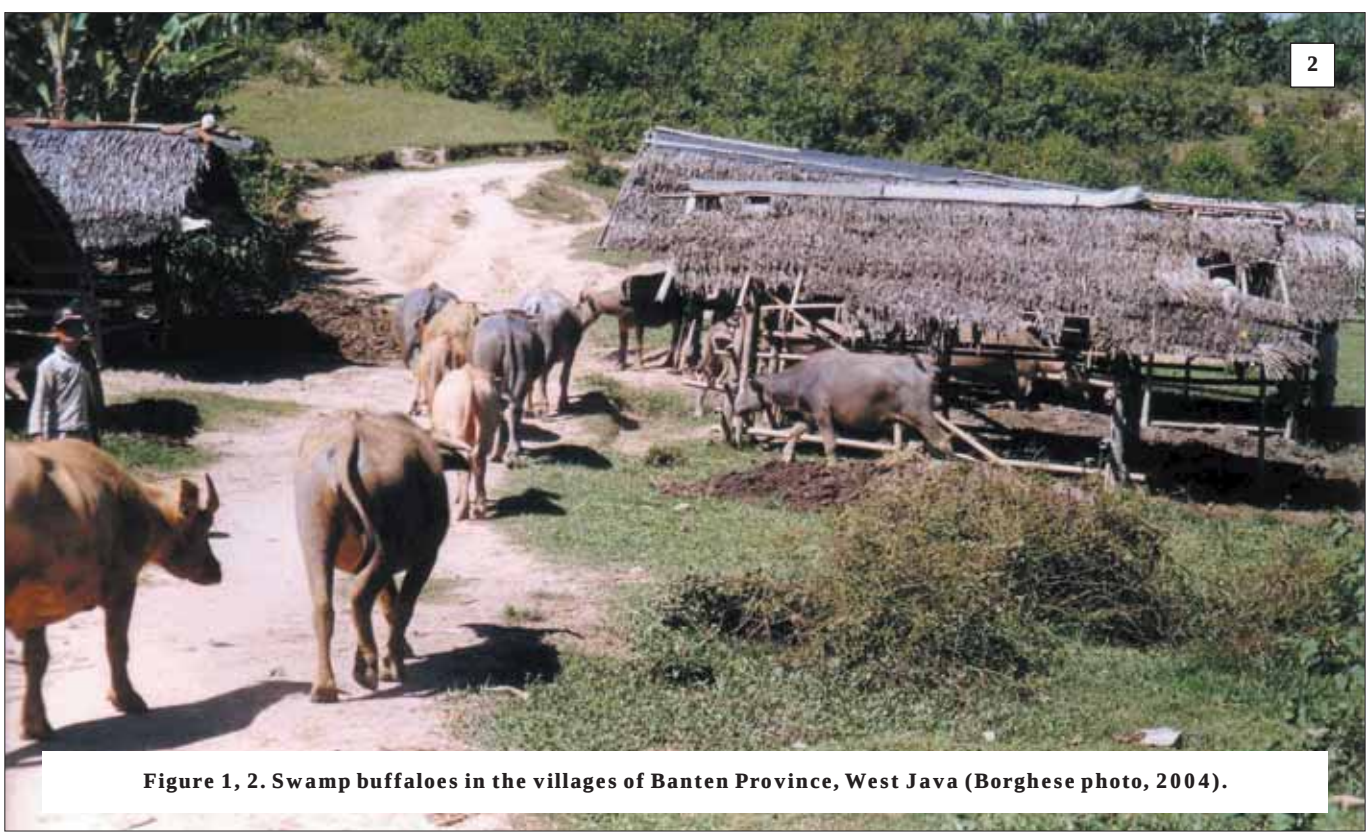

Figure 1, 2. Swamp buffaloes in the villages of Banten Province, West Java (Borghese photo, 2004).

BUFFALO DEVELOPMENT IN INDONESIA

[1] Antonio Borghese, [2] Erizal Sodikin
[1] FAO Buffalo Network Coordinator, [2] Embassy of Indonesia, Rome

In 1985 the total population of buffalo in Indonesia was 3,245 thousand, whereas in 1993, the total population was 3,238 thousand. Therefore according to these statistics in the period 1985 to 1993 the number of households was declining, until 2007 when the buffalo population was estimated about 2.500.000 heads, as reported by DGLS (2007).
The buffalo breeds have been classified as Swamp and River subspecies, and most of the Indonesian buffalo are included in the Swamp one, that consists of many types and varieties of breeds *(Borghese and Mazzi, 2005)*. There are varieties of the Swamp breeds in many different localities with divergences in size, weight, colour, marking and horn dimension. The Swamp buffalo is generally considered to be a working animal, but it also has a considerable capacity for milk production. Swamp buffalo are used for draught power in most areas and for beef in the Java lowland areas and the Sumatra uplands. Spotted buffaloes are highly prized (and therefore they command high prices) to be sacrificed and consumed on special occasions such as marriage ceremonies *(fig. 1)*.

Fig. 1. Indonesian Spotted Buffalo.

Fig. 2. Papangan Buffalo.

Most of the rural buffaloes maintained by small farmers in Indonesia produce less than 1 000 kg of milk per lactation. However, the production of fresh milk in Indonesia has not increased greatly over recent years and the level of production in the latter part of the 1990s was insufficient to satisfy the fast growing demand of milk, milk derivates, cheese and meat too. Around 90 percent of Indonesia's fresh milk production comes from smallholder dairy farms. Some of the problems these smallholders face are lack of capital, low technology, deficiencies in management of animal health, and insufficient human resources. In addition in the case of beef cattle and buffalo, it is common practice to tether them by the roadside, and in such cases, feed is cut and carried to them. Alternatively, they may be herded to "waste" areas where they graze on crop residues, and feed supplements are rarely given in sufficient quantities, and during the non-productive period, it is thought that farmers do not give the animals supplementary feed.
Therefore some projects were proposed to develop buffalo livestock and products for human needs.
For the correct application of the develop project a travel in Indonesia was combined for the knowledge of some buffalo realities in Sumatra. Prof. Antonio Borghese was invited for this purpose accompanied by Dr. Erizal Sodikin (Agriculture Attache, Embassy of Indonesia, Rome).

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In the Province of South Sumatra (Palembang is the Capital City), there is the OKI District, the Papangan Subdistrict, a livestock coastal area, very hot and wet marshlands, with the highest dampness as long as the humid season, where only buffaloes can survive, an original buffalo type called 'Kerbau Papangan' *(Papangan Buffalo, fig. 2)*.
It is Swamp buffalo, living and swimming in the marshes *(fig. 3 and 4)*, eating nature swamp grass: Kumpai Copper (Ischaenum Aristum Lina); Kumpai Oil (Himendchue Ampleacaulisness); Kumpai Paddy (Himenacjua Interupta Buese); Bento Creep (Caersia Hexandra SP); Parum (Heliochis Fistulosa SP). The buffaloes come on the islands where dairy buffaloes are hand milked, as we looked in Layan Village in Layan Island.
The milk production is about 800-1200 kg for lactation with a lactation lenght of 200-300 days.

Fig 3 and 4. Papangan Buffalo in the marshes.

Generally milk production not yet been marketed widely but is only processed traditionally in the form of sagon puan, buffalo oil, sugar puan, curdle and penjem.

1. Sagon Puan.
It is a product obtained mixing 4 litres of fresh milk, 16 egg yolk item (duck, rate chicken, chicken buras) and added by 1 sugar Singk, the mixture is swirled flatten later; then heated until 4-5 hours at the same time swirled tilt run dry to form the smooth item, if its items have flattened hence the process of sagon puan is completed, the endurance of sagon is about 6 month *(fig. 5)*.

Fig. 5. Sagon Puan.

2. Sugar Puan
Five milk litro mixed with 1 sugar singk swirled flatten; then filtered and is afterwards cooked / beat until the dough jell with the colour turn into yellowish.

3. Buffalo Oil
Fresh Milk precipitated for 5-6 hours, its tabletop in taking and in precipitated during 2-3 day. Water then its tabletop is again cooked/beat until brass colour filtered and filtered for the dissociation of colour yellow with chocolate as its dregs.

4. Curdle
One fresh milk litre mixed with one matured water tablespoon is later swirled flatten then the homogen precipitated during 24 hours until the curd formed. For the making of next curd in the place of matured water can be used the itself whey.

5. Penjem
The fresh milk is mixed with tape water (soft rice, cassava) as much 3-5 tablespoon and pack into the mug, it is at the same

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Fig. 6. Buffalos in West Sumatra.

Fig. 7. Buffalo hand-milking.

Fig. 8. Milk putting in bamboo-cane.

Fig. 9. Dadiah.

time swirled to be flatten; later then precipitated during 2-3 hours, penjem ready for consumption.

In West Sumatra (Padang is the Capital City), the buffalo management situation is totally different: the buffalo live free on the pasture in a beautiful panorama rich of rice-fields, sugar-can and oil-palms *(fig. 6);* the calves suckle milk from the mothers that, after calve suckling, are hand milked *(fig. 7)*; afterwards the milk is put in bamboo-cane *(fig. 8)*, where it is naturally acidified and fermented for 2 days. It is a particular product, named dadiah *(fig. 9)*, rich of probiotics, similar as taste to kefir

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Fig.10. Dadiah.

Fig. 11. Dadiah cutting.

or to yogurt but it is really a fresh cheese cream, rich of fat and protein. It is possible to conserve dadiah for 8 days and to distribute and sell it in many lands of Sumatra at the price of 7.000 rupias/piece *(fig. 10)*.When people like to eat dadiah, they cut the bamboo-can *(fig. 11)* and take it with a spoon to eat directly or with cereals, wheat, barley or rice *(fig. 12)*.

The buffaloes produce normally 1.2 litres for day for 8 months of lactation and the calves are weaned at the end of lactation. Farmers need to reduce milk consumed by calves to increase lenght of lactation and to increase milk production and dadiah distribution in the towns. Could be useful to leave only two teats to calves just after one week after calving to have the other two teats at disposition of milking, to achieve 3.000.000 rupies for lactation. Could be interesting the study of natural fermentation of buffalo milk due to the bamboo-can enzymes.

In the village of Sidodadi in North Sumatra (Medan is the Capital City), there are different farms of Murrah buffaloes *(fig. 13)*, imported by India many years ago, as people came from India too. The Murrah production is higher than in Swamp breeds, until 8 litres for day obtained in two hand milking for day. The calves stay with the mothers 6 months, that is the mean lenght of lactation.
It is possible to increase the production utilizing concentrate feedingstuffs as coconut powder with 50% protein, rice bran, palm oil.
After this experience the proposal activities

Fig. 12. Dadiah with dried gluten rice.

Fig. 13. Murrah buffalo in North Sumatra.

in Sumatra farms can be the following:
1. Early weaning of calves: it is possible to

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obtain the weaning at 3 months of age, utilizing milk substitutes or other by-products (from coconut, rice, palm), to increase the milk availability.
2. Meat line: with feedingstuffs produced in Indonesian industry it is possible to organize an efficient fattening of calves, increasing the daily weight gain and reducing the slaughter age.
3. Early puberty in the heifers: the age at puberty can be easy reduced introducing in the diet some industrial feedingstuffs or by-products.
4. Animal recording: it is a priority the introduction of animal recording in the farms by the Livestock services, measuring the milk production every month for each lactation; the results will be the clear idea of the real production genetic capacity of the buffaloes and the basis of selection of the more productive lines.
5. A.I.: the more production lines will be the basis of constitution of selection nucleus and of the application of Artificial Insemination (AI), utilizing the Italian Mediterranean buffalo semen, the best in the world, to increase rapidly the milk production in F1.
6. Ovulation control: the ovulation control will be obtained by synchronization schedules, increasing the reproduction efficiency at A.I.
7. Nutrition schemes: the application of correct diets will satisfy the requirements of dairy buffaloes increasing the milk production.
8. Creation of milk processing industry in Indonesia: it is possible by the increased milk production to put the basis of a cheese industry with many diversified products: traditional ones (didiah, sagon and sugar puan, buffalo oil, etc) and new ones for the international market (mozzarella and other cheeses).

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