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

BUFFALO INTERNATIONAL ACTIVITIES

During the year 2006, after the 5th Asian Buffalo Congress (Nanning, China, April 18-22) of which we have reported in number 21 of the Buffalo Newsletter, other important events and international congresses took place.
The book "Buffalo Production and Research" is now available on the FAO web site in HTML version at *http://www.fao.org/docrep/010/ah847e/ah847e00htm* and in PDF version at *ftp://ftp.fao.org/docrep/fao/010/ah847e/* , so it can be now read electronically by all people in the world; the hard copy is still available by asking the Editor of the Buffalo Newsletter.

An international meeting was organized by the Standing Committee on Farm Management of IDF (International Dairy Federation) on buffalo milking equipment and methods and was held in Tormancina farm (CRA, Istituto Sperimentale per la Zootecnia, Monterotondo, Roma) on August 31-September 2, 2006.
In this meeting, the milking systems and the recording equipments of buffalo management in Italy were presented by prof. Antonio Borghese and discussed with the participating people. A practical demonstration of milk flow measurement with lactocorder was made in the Tormancina milking parlour; moreover modern processing systems for the production of mozzarella and other buffalo cheese and by-products were shown in Mozza Re factory. At the end of the meeting, the IDF Committee established to produce an IDF Bulletin on "Milking Management of Dairy Buffaloes" with the following chapters: 1, World dairy buffalo production and strategies; 2, Milk composition and quality; 3, Anatomy of the buffalo udder; 4, Physiology of milk ejection; 5, Milkability of buffaloes; 6, Udder health; 7, Milking machines for dairy buffaloes; 8, Milking routine; 9, Milking hygiene; 10, Storage of milk; 11, Milk recording.
The third Symposium on buffaloes of Americas (Second Symposium on Europe-America Buffaloes) was held in Hotel Intercontinental in Medellin, Colombia on September 6-8, 2006, organized by the Colombia Buffalo Association (Ing. Ricardo Botero as President, Dr. Claudia Roldàn de Sierra as Vice-President). 700 people took part, coming from different countries (Venezuela, Brazil, Argentina, Cuba, Panama, Ecuador, Guatemala, Italy and, of course, Colombia). The Proceedings book, with different chapters (Buffalo in the world, management, nutrition, genetics, marketing, reproduction, health, pasture) in 263 pages, was given to the participants to the Symposium.
During the Symposium, on September 6, the IBF (International Buffalo Federation) meeting was held with the presence of many delegates of different countries. The President, prof. Luigi Zicarelli, showed a preliminary programme of the 8th World Buffalo Congress in Caserta, Italy and asked help and suggestions to the colleagues. It was established that the 4th Symposium on buffaloes of Americas will be held in Venezuela on October 2008, as Argentina confirmed the candidature for the 9th World Buffalo Congress in 2010.
After the Symposium, on

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September 9-12, a buffalo tour was organized by Colombia scientists and farmers with the visit of different buffalo realities in Colombia, starting with the visit of the great lagoon "Ayapel" in Cordoba Province. Travelling on canoes for 4 hours the "Los Pajaros" farm of Jorge Luis Ochoa was reached, where 4000 buffaloes are reared with an average milk production of 4.3 liters/day. The following day , September 11, the farm "Agua Clara" of Juan Gonzalo Angel Restrepo was visited using horses, were buffaloes of different breeds (Brazil Murrah, Mediterranean Italian and different crosses) are kept on natural pastures. The milking was made by hand, with the calves besides the dams, and milk production was 4 liters/day. The day after the "Tanzania" farm in Cordoba Province, with a big milking parlour, was visited; the last one was "Fortaleza" farm of the family of Claudia Roldan de Sierra, where a typical lunch in Colombian style was served. On September 21-22, the "Buffeltag" was held in Center Hotel "Alte Spinnerei" in Burgstadt, Saxony, Germany. This event is commented in this Newsletter.

Antonio Borghese

5TH GERMAN BUFFALO DAY

Andrea S. Guglielmetti

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The 5th German Buffalo Day, a yearly national meeting of German buffalo breeders, took place on September, 22nd in Penig – Chursdorf /Germany. It has been organized by the Association of Saxon Buffalo Breeders.

The meeting aims on further enhancing buffalo production in Germany, by passing on information to the buffalo breeders. Invited speakers gave reports on the following topics:

– status quo of buffalo breeding in different countries of Europe and worldwide

– status quo of buffalo breeding and performance in Germany

– reports on recent scientific studies on quality and peculiar characteristics of buffalo products with regard to marketing

Furthermore, the meeting provided an opportunity for sharing of experience between buffalo keepers and to learn from international experience.

In his opening speech, Manfred Thiele, president of the German National Buffalo Breeders Association and of the Saxon Buffalo Breeders Association gave a review on the history of buffalo keeping in Germany. He remembered Georg Dattler, who founded on 1917 the first German Buffalo Association and was the first to formulate what are still the guidelines in the breeding of the Central European Buffalo: the improvement of performance of buffalo in respect of milk and meat production without deterioration of the animals robusteness.

The main lecture of the day was given by Prof. Dr. A. Borghese, General Secretary of the International Buffalo Federetion, Director of the Buffalo Department in the Animal Production Institute and Coordinator of the FAO Buffalo Network on "Buffalo population in Europe and Near East". The presented data showed actual buffalo population size and performance level in different countries, with emphasis on the Mediterranean area. It was indicated that in several countries buffalo population is decreasing rapidly due to holsteinization and mechanization. A strong relation between development of buffalo production of a country and marketing was identified: in fact, buffalo numbers and production increase in the countries where buffalo products are regarded as higher quality dairy products and can be sold at higher prices. It was concluded that buffalo breeding has to be product oriented, like in Italy where a selected dairy purpose breed was created to produce "Mozzarella di Bufala Campana D.O.P." a special cheese, Denomination Origin Protected , with registered mark in E.U.

Subsequently, Prof. Dr. Peeva from Agricultural Institute Shumen / Bulgaria and Vice President of Internationl Buffalo Federation for Europe reported on the current status of Bulgarian buffalo breeding with special regard to the Bulgarian Murrah. Data about the actual performance level of Bulgarian buffalo were presented

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and an inside to the applied selection strategy and main causes of culling were given.
Afterwards, Dr. Golze gave a lecture on the results of buffalo production in Germany. He reported on the characteristics of buffalo meat and its superior tenderness in comparison to beef. Dr. Westphal, from the Saxon Regional Office of Agriculture demonstrated in practice the measurement of the tenderness.
In the following presentation, Dr. L. Vidu, from the University of Bucarest / Romania, reported on comparative studies between cattle and buffalo regarding the content of various proteins in muscle.
Subsequently, Dr. R. Schafberg and Dr. R. Schmidt from the Institute of Agricultural and Nutritional Science, Department of Animal Breeding, Martin Luther University of Halle- Wittenberg, Germany, gave a report on the size distribution of fat globules in buffalo milk. First results of comparative study between buffalo and cow milk were presented. The study was intented to give essential information on qualitative and processing characteristics of buffalo milk. It was found that in buffalo milk fat globules show great variability. The majority of fat globules were smaller than 2µm, but fat volume is formed mainly by globules reaching in size from 3-7µm.
Other German officials of livestock planning and dairy recording, as well as scientists and members of local government attended the meeting.
Finally there was a presentation of outstanding breeding stock.
In his conclusion, Manfred Thiele expressed the hope that the cooperation between science and buffalo breeding will continue and so to promote advancement and further development of the Central European buffalo.
Afterwards, Dr. Golze, from the Saxon Regional Office of Agriculture, gave a lecture on the results of buffalo production in Germany.
As the buffalo population in Germany is still small, numbering about 1400 heads, he referred in his report as the two biggest buffalo herds of Saxony, counting more than 90 animals each. All of these buffalos are recorded in the German livestock milk recording system.
Dr. Golze reported the registered values for traits like fertility, milk and growth performance relating to the years

2004/2005 as is shown in the tables 1 and 2. Weight at birth was 44.7 kg for male buffalo calves and 39.5 kg for female buffalo calves. Weight at 3 months was 147.0 kg for male calves and 132.4 kg for female calves. Weight at 9 months was 351.2 kg for male calves and 305.7 kg for female calves.
Males were used for breeding from the age of two years.
Buffalo heifers were first mated at the age of 18 to 24 months. Age at first calving was 35 months on average. Time between calvings were on average 633.5 days.

Table 1. Fertility and growth traits of buffalo cows of the Chursdorf farm in 2004/2005.

	Male	Female
Weight at birth (kg)	44.7	39.5
Weight at 3 months (kg)	147.0	132.4
Weight at 6 months (kg)	248.1	225.1
Weight at 9 months (kg)	351.2	305.7
Age at first mating (months)	24	18-24
Age at first calving (months)	-	35 (24-50)
Time between calvings (days)	-	633.5

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He mentioned that buffalo bulls were commonly slaughtered at a weight between 540 and 760 kg.
Regarding milk performance, Dr. Golze reported that in the Chursdorf herd the 305-day milk yield was on average 2232 kg in the first lactation and 2577 kg in the second lactation as it is shown in *Table 2*. Fat yield was 193.7 kg in the first lactation and 237.7 kg in the second lactation. Protein yield was on average 101.0 kg and 123.7 kg for the first and second lactation respectively. There was found a big variation for these traits.

Table 2. Milk performance of buffalo cows over a 305-day lactation period of the Chursdorf farm in 2004 / 2005.

	1st lactation (n=10)	2nd lactation (n=8)
Milk yield (kg)	2232 (1479 - 3895)	2577 (1623 – 4031)
Fat yield (kg)	193,7 (122.0–320.9)	237.7 (134.7 – 355.4)
Protein yield (kg)	101.0 (67.7 – 170.2)	123.7 (71.6 – 196.0)

VIII WORLD BUFFALO CONGRESS

OCTOBER 19-22, 2007, CASERTA, ITALY

Hotel Crowne Plaza - Congress Centre

Pre-Congress
Course on CHEESE MANUFACTURING TECHNOLOGIES

15 OCTOBER 2007

9,00 - 12,00	Francesco Addeo e Lina Chianese: "Processing of buffalo milk in high quality products"
12,00 - 13,00	Remo Rosati: "Milk bacteriological analysis"
15,00 - 16,00	Giorgio Galiero: "More frequent mammary diseases in buffalo cow"
17,00 - 19,00	Maria Luisa Cortesi: "Control and inspection of buffalo cheeses"

Pre-Congress
Course on CHEESE MANUFACTURING TECHNOLOGIES (morning)
and
Course on BUFFALO BREEDING MANAGEMENT (afternoon)

16 OCTOBER 2007

8,00 - 13,00	Practical activity in buffalo cheese factory
15,00 - 16,00	Serena Calabrò: "Feeds evaluation"
16,00 - 17,00	Luigi Zicarelli: "Buffalo milk yield and chemical composition"
18,00 - 19,00	Federico Infascelli: "Nutritive requirements"
19,00 - 20,00	Giuseppe Campanile: "Feeding and reproduction"

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Pre-Congress

Course on CHEESE MANUFACTURING TECHNOLOGIES (morning)

and

Course on BUFFALO BREEDING MANAGEMENT (afternoon)

17 OCTOBER 2007

8,00 - 13,00	Practical activity in cheese factory
15,00 - 16,00	Luigi Zicareli: "Buffalo cow reproductive seasonality and seasonal anaestrum"
16,00 - 17,00	Rossella Di Palo: "Economical aspects of out of season calving technique"
17,00 - 18,00	Vincenzo Peretti: "Congenital defects in buffalo"
18,00 - 19,00	Monica Cutrignelli: "Weaning and production of buffalo heifers and young bull"

Pre-Congress

Course on BUFFALO BREEDING MANAGEMENT

18 OCTOBER 2007

9,00 - 14,00	Practical aspects of buffalo breeding management in a farm of Salerno province
15,00 - 17,00	Practical aspects of buffalo breeding management in a farm of Salerno province

8th WORLD BUFFALO CONGRESS

19 OCTOBER 2007

Invited lectures

9,00	Libertado Cruz: "Present and future of Carabao Buffalo in Asia"
9,30	Yang Bingzhuang: "Problems of buffalo breeding in the small farms"
10,00	Dhanda: "Buffalo as milk producer in Asia"
10,30	Ranjnhan: "Buffalo as meat producer in Asian warm-wet areas"
11,30	CS Thomas, A Borghese, MD Rasmussen: "Milking management of Dairy buffalo"
12,00	Addeo-Chianese: "Tradiditional and innovative products from water buffalo milk and whey"
12,30	Prof. dr. Talat Naseer Pasha: "Comparison between bovine and buffalo milk yield in Pakistan"
13,00	Metha Wanapat: "Nutrition and Feeding of Swamp Buffalo: Feed Resources and Rumen Approach"
16,30	Opening Ceremony in Caserta Royal Palace

20 OCTOBER 2007

8,30	Mishra: "In vivo embryo production: present and perspectives"
9,00	Gasparrini: "In vitro embryo production in buffalo: current situation and future perspective"
9,30	Parnpai: "Production of cloned embryos in buffalo"
10,30	D'Occhio Michael: "The control of ovulation after superstimulation of ovarian follicular growth in buffaloes"
11,00	Baruselli: "Fixed- time artificial insemination"

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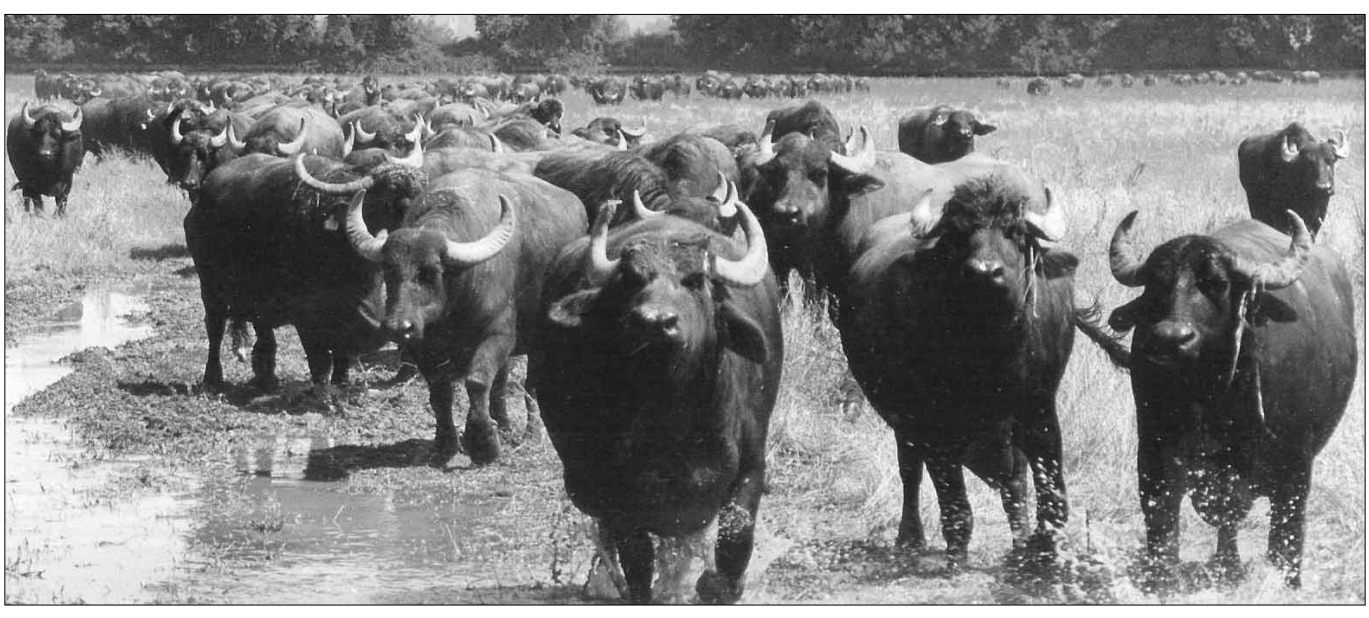
11,30	Campanile, Neglia: "Embryo mortality in buffalo"
12,00	Vale: "Environmental factors affecting reproduction in buffaloes"
12,30	Zicarelli: "How buffalo is a hypofertile and not precocious species?"
15,30 - 19,00	Oral Comunications"

21 OCTOBER 2007

8,30	Reggeti, Bernardes, Bennet, Roldan & Zava: "Buffalo in the Americas"
10,30	Farmers day
11,00	Meeting with buffalo farmers
8,30 - 17,00	Oral comunications
17,00	IBF Meeting

22 OCTOBER 2007

8,30	G.V. Pelagalli: "Morphological studies in the buffalo as a contribution to biotechnological methodologies in the animal production"
9,00	Iovane and Galiero: "Emerging pathologies in buffalo species"
9,30	Antonio Fagiolo: "Mastitis in buffalo"
10,00	Cringoli: "Parasites in buffaloes"
11,00	E.R.Orskov: "Physical, Physiological and Biochemical adaptation of livestock to different climates including buffaloes"
11,30	Antonio Borghese and Luigi Zicarelli: "Buffalo as a social animal for the humanity"
12,30	Iannuzzi: "The water buffalo: evolutionary, clinical and molecular cytogenetic"
13,00	Amaral: "Buffalo Genomics"
16,00 - 19,00	Oral Comunications



NUTRITION REPRODUCTION OF INDONESIAN BUFFALO: AN EXPERIENCE FROM SUMBAWA BUFFALO

Suhubdy

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ABSTRACT

Buffalo is one of the potential of the Indonesian ruminant livestock for meat and milk production. Compared to cattle, the population of this animal showes slow progress. This may be related to several problems, ranging from technical to non-technical constrains such as physiomorphological characteristics, feed and nutrition, genetics and reproduction, and socio-cultural aspects. This paper describes the nutrition and reproduction aspects with special reference to Sumbawa buffalo. Evidence from the field study proved that improving the nutritional status during lactating period could enhance the performance of buffalo cows, milk production, and health of the buffalo calves.

Keywords: Sumbawa buffalo, nutrition reproduction, milk production, calf performance.

INTRODUCTION

Indonesian buffaloes are mostly owned by farmers who live in the rural area and reared on traditional extensive management systems. There is no special attention given to their nutritional status. Buffaloes graze commonly on communal rangeland (grassland) areas, road sides, river banks, or on the paddy field after harvesting. The quality, availability, and dynamic growth rate of natural grass as roughage feed are influenced by the variation of year round rainfall. As a consequence, the nutrient and water uptake and nutritional status of the buffaloes may be insufficient. These conditions may cause the low level of production and reproduction rates.

Low reproductive performance of buffalo elsewhere (particularly in developing countries) may be related to lack of feeding system, management, husbandry practice, and environment *(Suhubdy, 2006a, 2006b; Aleandri, 1998; NRC, 1981; Rajhan and Pathak, 1979)*. This paper describes the nutrition and reproduction performances of Indonesian buffaloes with special reference to Sumbawa buffalo.

The nutritional status of farm animal especially during the reproductive stage is critical. Any effort being applied in this condition may give positive impact on the development of the parents and the offspring. Limited number of nutritional research has been done aiming at improving the nutrition of buffalo in Indonesia. According to Ligda (1999), adequately nourished buffaloes can reach puberty at about the same age as cattle, as early as 18 months of age in buffalo bull. He also reported that an experiment conducted to swamp buffalo at Queensland, Australia and in Papua New Guinea, it was noted that female buffaloes came into oestrus even while they were losing weight because of not adequate nutrition, whereas cattle did not. Under these stressful conditions the buffalo calves also reached sexual maturity earlier and the buffaloes had a higher calving percentage and a shorter calving interval because they came back into oestrus more quickly than cattle. This evidence suggests that buffalo would exhibit better performance if they are kept on better nutrition. Rajhan and Pathak (1979) also revealed that the slow development of buffalo is related to very little information on nutrition in relation to reproduction and this is one of the greatest bottleneck in the future development of this species. According to the information obtained by direct investigation in the field and interviewing the buffalo farmers *(Suhubdy et al., 2004; 2006a)*, the reproduction rate of Sumbawa buffalo are relatively low *(Table 1)*.

The above evidences suggest that managing the nutrition of buffaloes during the period of lactation or reproduction state could

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Table 1. Reproduction characteristics of Sumbawa Buffaloes.

No.	Variables	Values
1	Age of puberty (male vs female)	24.7 vs 27.2 months
2	Age first calving	3.98 years
3	Oestrus after post partum	1.85 months
4	Mating post partum	4.62 months
5	Conception rate	2.69 times
6	Duration of pregnant	11.00 months
7	Calving interval	17.30 months
8	Age of first mating (male vs female)	2.54 vs 3.04 years
9	Age of selling (male vs female)	4.77 vs 11.07 years
10	Duration used in breeding (male vs female)	2.30 vs 8.00 years

Source: Suhubdy et al. (2004; 2006a).

have an influence on the life cycle, development of embryo, milk production, and in turn the survival of newborn animal. Nutritional requirements in buffalo cows and heifers are particularly described, with a rich review, by Terramoccia et al in the FAO book of "Buffalo production and research" *(Borghese, 2005).*

IMPROVING NUTRITIONAL STATUS DURING LACTATION PERIOD: AN EXPERIENCE FROM SUMBAWA BUFFALO

Until recently, limited research has been done aiming at improving the husbandry and performance of Indonesian buffaloes. Intensive study conducted in Sumbawa Regency has identified at least 15 serious problems facing the slow progress of population of Sumbawa buffalo *(Suhubdy el al., 2004, 2005; Suhubdy, 2005, 2006a, 2006b).* Some of those are either directly or indirectly related to reproduction aspects. Those are as follow: (1) low level of milk production (0.6 – 1,0 L/day) during the period of lactation and this amount was not enough to support the calf nutrition requirements, (2) the mortality of calves was high (30-40%) due to the poor body conditions at the time of birth as a result of low status of nutrition during the period of pregnancy, (3) in the dry season, decreasing live weight makes animals susceptible to illness, (4) there was no farmer intervention in the process of buffalo mating (artificial insemination), (5) there was no grassland area belonging to farmers, and also no effort has been given to the improvement of communal grazing land, (6) many lactating female buffaloes give birth in onset of the dry season (April-July) causing lack of calf's survival ability, (7) high rate of slaughtering of lactating females, and (8) limited number of top bull that are available for breeding due to increasingly market demand of the certified bull in the country and overseas.

To overcome the facing problems of Sumbawa buffalo *(Figure 1)* development, an on-farm trial was conducted aimed at improving reproduction performance of Sumbawa buffaloes (cows and calves)

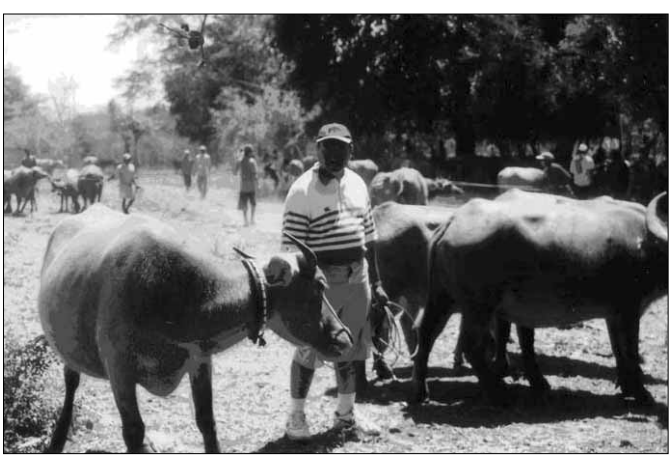

Figure 1. Sumbawa buffalo herd (Suhubdy doc., 2004).

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during the period of dry season. The trial was conducted in harsh environment at eastern site of Sumbawa Regency where the population of buffaloes is dense.
As identified in the previous study the farmers raise their buffaloes on free-ranging feeding management. The intake of nutrients depends upon the dynamic of vegetation growth rates, so affecting the buffalo performance and the amount of milk produced. Data from survey proved that lactating Sumbawa buffalo produced a limited amount of milk, averaging 600 mL/day/head *(Suhubdy et al., 2004)*. This may be the main cause of high mortality rate of buffalo-calf *(Suhubdy et al., 2004, 2005; Suhubdy, 2005a)*. Due to this problem, a trial has been conducted to improve milk production and performance of the calves. To do this, feed supplementation has been applied. The supplemental diet given (known as *Ronaksia = Roti Ternak Ruminansia*) was similar to that applied in the previous feeding trial on buffalo-beef *(Suhubdy et al., 2004)*. The Ronaksia was composed of 3 kg rice bran fortified with 70 g urea, 100 g rice flour, and 50 g kitchen salt *(Figure 2)*.

Figure 2. Lactating buffalo cows eating Ronaksia placing in the plastic bucket (Photo Suhubdy, 2005).

The buffaloes used in this trial were chosen from herds belonging to five farmers. The buffalo cows have been milked during 3-4 months of lactation and were at 3rd-4th calving. Fifteen lactating buffalo cows were grouped into three group of five based on the three types of raising management: Group (A) raised freely on rangeland for 24 hours with no supplement, (B) treatment A + Ronaksia, and (C) all buffalo cows penned for 24 hours and consumed a basal diet of rice straw provided *ad libitum + Ronaksia*. Drinking water was provided from a well located adjacent to the animal pen. Daily milking activity was done by hand before morning feeding, by two experienced persons *(Figure 3)*. The average milk production recorded in this trial is depicted in *Figure 4*.

Figure 3. Milking activity by hand (Photo Suhubdy, 2005).

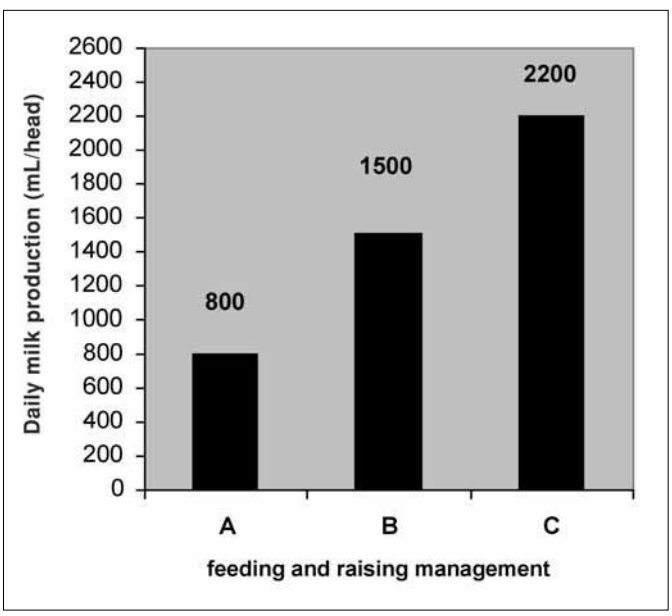

Figure 4. Response of lactating Sumbawa buffaloes (total n = 15) to improvements of feeding management: (A) free ranging, (B) free ranging + Ronaksia D, and (C) penned 24 hours + Ronaksia D (Suhubdy et al., 2005).

Figure 1 shows that buffaloes in group A, grazing freely during 24 hours on natural grassland produced milk by less then one liter a day. While the buffaloes in group B produced milk two fold and the C group nearly three fold of that of group A. This finding explains clearly that Sumbawa buffalo (or others) could be improved milk

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production by enhancing their feeding and husbandry managements. In the reproductive stage, the amount of milk production would affect the performance of calves. For the Sumbawa buffaloes, the milk from the cows was not only drunk by the calf but also by the owner. Therefore, increasing the amount of milk production during lactation period would give double benefits.

Besides, result from this trial proved that improving the status of the buffalo cows during lactation has affected the performance of the calves. Before the trial, it was found that the newborn Sumbawa buffalo calves were weak, had poor conditions, and low birth weight. This may be related to the limited nutrients uptake during the stage of pregnancy as caused by poor nutritional status of the cows. Shortly, improving the performance of buffalo cows by supplemental feeding has affected the milk production *(Figure 5)* and in turn the performance of the buffalo calves.

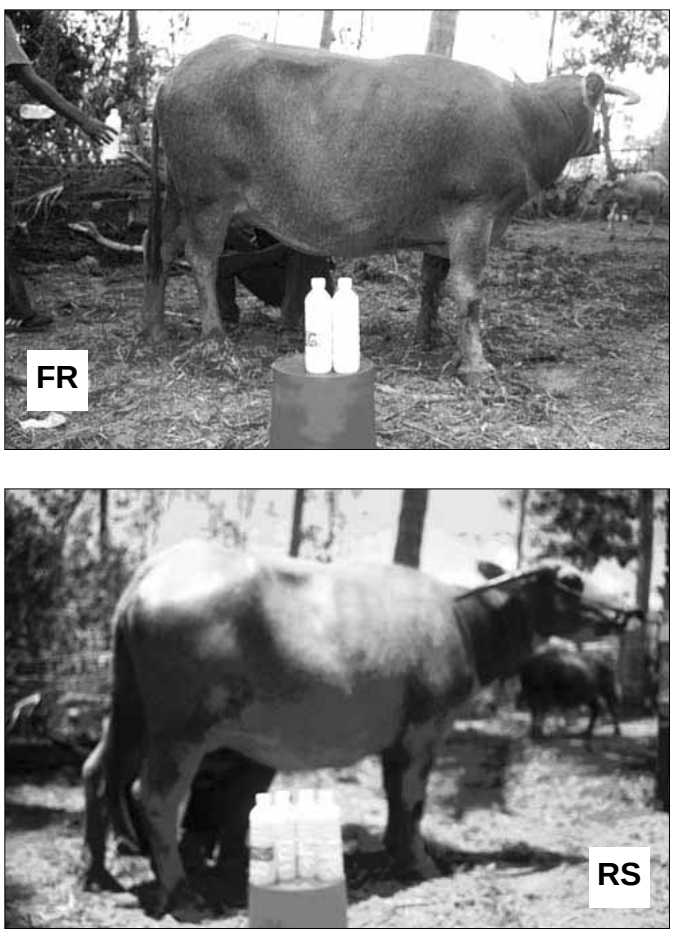

Figure 5. Milk production of buffalo cows: raising with free ranging management (FR) raising in stall feeding management (RS) (Photo Suhubdy, 2005).

CONCLUSION AND RECOMMENDATION

The main constrain on Indonesian buffalo development is due to lack attention to nutritional aspect and management, especially in the reproductive period. Giving feed supplement during the lactation period would improve the performance of buffalo cows, milk production, and health and performance buffalo-calf. For future production and reproduction development, it is a need to improve the nutritional management of Indonesian buffaloes by feeding them with balanced-ration and increasing feeding regime according to the physiological status, availability of local feed resources, and work loads. In addition, the future research agendas should be directed to establish the basic data on ingestive and feeding behaviors; feed and water intake; grassland production; environmental stress and head load; productive and reproductive performances; and socioeconomic contributions.

ACKNOWLEDGEMENT

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PREDICTION OF HERD LIFE MILK PRODUCTION AND PROFITS IN BUFFALOES

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Data on 1753 buffaloes of 3 genetic groups (Murrah, Graded Murrah and Nili Ravi) from six military dairy farms of northern India were utilized to predict profits. The milk production in the herd life was 5381.07 kg and profit of herd life was Rs.8698.62. Two different production functions namely linear multiple regression and Cobb-Douglas type were fitted to express the variation in herd life milk and profit. Based on coefficients of determination (R^2) values, it was recommended that linear milk production function is better predictor of herd life milk yield and profit than Cobb Douglas production function. It was further observed that first lactation milk yield, first calving interval and profit during first lactation could be used for prediction of herd life milk yield and profit.

Predicting herd life milk yield and total profit in buffaloes is of primary importance for dairy herd men. Some of the economists selected linear and Cobb-Douglas production function to optimize level of concentrate in cows and buffaloes *(Aul et.al; 1974)* where as others fitted Cobb-Douglas production function to assess the resource productivity in milk production and returns from local cows, crossbred and Murrah buffaloes based on green and dry fodder, concentrate and human labour *(Chhikara & Gangwar; 1975 and Arora et al. 1994)*. Information on herd life milk production and profit by Cobb-Douglas and linear production function from the traits of first lactation of buffaloes could not be traced in literature. Therefore an attempt was made to predict the herd life productivity and profit in buffaloes maintained at military dairy farms of India.

MATERIALS AND METHOD

Data on 1753 buffaloes who have completed at least three lactations from 1953 to 1984 and belonged to 3 genetic groups (Murrah, Graded Murrah and Nili Ravi) were collected from six military dairy farms namely Agra, Ambala, Bareilly, Ferozpur, Lucknow and Meerut & were used for prediction of herd life profits. Income and expense were calculated as per Kumar (1998). First three lactation's total milk yield and profit was considered as herd life milk production and profit. Linear and Cobb-Douglas production functions represented mathematically as fallows for the present study:

Linear production function:

$$y = a + \sum_{i=1}^{8} bi\ zi$$

Cobb-Douglas type production function:

$$y = a \prod_{i=1}^{8} zi^{bi}$$

Where y was milk production or profit, 'a' was point or intercept (or constant), bi were partial regression coefficients for independent variables, zi were independent variables like age at first calving in days (AFC), weight at first calving in kg (WFC), first lactation period in days (FLP), milk yield in first lactation in kg (FLMY), first calving interval in days (FCI), average milk production per day of first lactation in kg (AFLMY), profit during first lactation in Rs. (PFL) and average profit per day of first lactation in Rs. (AFLP). Different combinations of the independent variables were used for prediction equation after due correction for significant effect of genetic group, season and period of calving and form. Therefore, herd life milk production and profit was considered as function of AFC, WFC, FLP, FLMY, AFLMY, PFL, FCI, & APFL while other factors were unidentified therefore could not be considered. Thus in all 28 functions were fitted. The better-fit function was tested by the estimation of R^2 for each function.

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Table 1. **Least squares mean and standard error of independent and dependent variables.**

Traits	Mean	Murrah	Graded buffalo	Nili Ravi
Independent traits				
Age at first calving in months	41.12 (0.35)	40.73 (0.64)	41.27 (0.36)	41.35 (0.43)
Weight at first calving in kg	483.58 (2.96)	469.32[b] (6.03)	486.89[ab] (3.11)	494.54[a] (3.93)
First lactation period in days	302.75 (2.66)	301.42 (5.29)	299.95 (2.72)	306.87 (3.45)
First lactation milk yield in kg	1818.41 (21.26)	1898.66 (41.31)	1789.00 (21.95)	1770.58 (27.20)
First calving interval in days	471.99 (5.74)	476.31 (11.38)	476.68 (5.93)	471.09 (7.42)
Average milk production per day of first lactation in kg	3.95 (0.07)	4.29 (0.13)	3.96 (0.12)	3.76 (0.12)
Profit during first lactation in Rs.	1992.02 (370.79)	2741.34 (741.81)	1817.24 (383.98)	1417.48 (481.11)
Average profit per day of first lactation in Rs.	5.43 (0.08)	5.61[a] (0.15)	5.40[b] (0.08)	5.27[c] (0.10)
Dependent Traits				
Herd life milk yield (kg)	5381.07 (66.63)	5567.92[a] (126.04)	5282.91[b] (68.61)	5292.38[b] (84.07)
Herd life profit (Rs.)	8698.62 (946.49)	10862.96 (1889.61)	8232.42 (979.99)	6998.49 (1226.71)

(Figures within parenthesis are respective standard error)

RESULTS AND DISCUSSION

Least squares mean of all the dependent and independent variables in all the three genetic groups have been presented in table1. Age and weight at first calving was least in Murrah breed and maximum in Nili Ravi but the differences were not significant. Milk productions in first lactation of Murrah buffaloes was significantly higher over other two genetic groups. They're no differences in first lactation period and first calving interval. Herd life milk production was significantly more in Murrah but profit during herd life could not be different in all the three breeds. Therefore, it seemed that in addition to milk production, other factors play role in determining the profit.

The results of seven different combination of explanatory variables like AFC, WFC, FLP, FLMY, AFLMY, PFL, FCI, & APFL were considered for multiple leaner regression coefficients estimates and have been presented in table 2. The regression coefficient estimates of WFC, FCI, FLMY & PFL were found to be significant in all most all combinations of explanatory variables or input considered in the present equations. Results indicated that 1 kg weight or I kg first lactation milk yield could increase 1.6 to 3 kg herd life milk yield in buffaloes. Coefficient of determination (R^2) presented as percent were all significant at $P<0.01$ and indicated that the explanatory variables considered in the present equations were responsible for explaining 33 to 67 per cent of variation in herd life milk yield. Regression coefficient of AFC, FLP, AFLMY, and APFL were mostly non significant indicating their less importance in explaining the variation in herd life milk yield as compared to significant effect of WFC, FLMY, FCI and PFL. All the eight traits could explain 67.8 % of variation in predicting herd life milk yield. A reduction of 2.39 percent (67.84 – 65.55) in R^2 value was noticed when only three traits FCI, FLMY and PFL could be used for prediction of herd milk yield where all three partial regression coefficients were significant. Therefore, it could be concluded that instead of eight traits only three traits (first calving interval, first lactation milk yield and profit during first lactation could be included in multiple linear equation for prediction of herd life milk yield in buffalo). The result of Cobb Douglas production function of herd life milk yield in the same combination as per linear production function has been presented in table3. The partial regression coefficient for only first lactation profit was

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Table 2. Prediction of herd life milk yield from first lactation traits by linear milk production function.

Combination of traits	6,7,8	4,5,7	2,3,5,6	1,2,3,7,8	3,4,5,6,7,8	1,2,3,4,5,7	1,2,3,4,5,6,7,8
Point of intercept	3857.46	1030.02	1930.86	- 201.93	486.78	- 572.05	- 1126.08
Partial regression coefficients							
AFC (1)	-	-	-	5.34 (3.48)	-	0.76 (2.75)	0.66 (2.73)
WFC (2)	-	-	0.15 (0.35)	1.69** (0.35)	-	2.98** (0.27)	2.98** (0.27)
FLP (3)	-	-	-0.17 (0.60)	9.35** (0.43)	- 0.17 (0.46)	- 0.39 (0.44)	- 0.27 (0.44)
FCI (4)	-	2.79** (0.19)	-	-	3.99** (0.53)	3.27** (0.22)	4.34** (0.52)
FLMY (5)	-	1.61** (0.44)	1.75** (0.09)	-	1.27** (0.15)	1.61** (0.04)	1.28** (0.15)
AFLMY (6)	6270.87 (7332.24)	-	100.74** (36.30)	-	- 2565.35 (5284.77)	-	- 3014.71 (5118.39)
PFL (7)	0.062** (0.003)	- 0.099** (0.002)	-	0.082** (0.003)	0.100** (0.002)	0.108** (0.002)	0.10** (0.002)
APFL (8)	- 4213.90 (5239.94)	-	-	289.11** (16.13)	1946.99 (3772.23)	-	2263.68 (3653.45)
Coefficient of determination.(%)	33.41**	65.55**	40.99**	47.46**	65.67**	67.73**	67.84**

*(Figures within parenthesis are respective standard error, ** P< 0.01)*

Table 3. Prediction of herd life milk yield from first lactation traits by Cobb Douglas production function.

Combination of indipendent variables	6,7,8	4,5,7	2,3,5,6	1,2,3,7,8	3,4,5,6,7,8	1,2,3,4,5,7	1,2,3,4,5,6,7,8
Point of intercept	9.195	3.364	4.078	4.748	3.507	2.383	2.259
Partial regression coefficients							
AFC (1)	-	-	-	0.030 (0.032)	-	0.0007 (0.028)	0.0014 (0.028)
WFC (2)	-	-	0.027 (0.030)	0.076 (0.030)	-	0.144** (0.027)	0.144** (0.026)
FLP (3)	-	-	-0.005 (0.036)	0.473** (0.028)	- 0.001 (0.032)	- 0.004 (0.032)	- 0.004 (0.032)
FCI (4)	-	0.168 (0.022)	-	-	- 2.231 (8.780)	0.185** (0.026)	- 1.498 (8.712)
FLMY (5)	-	0.555 (0.018)	0.560** (0.035)	-	2.956 (8.779)	0.556** (0.019)	2.240 (8.711)
AFLMY (6)	3.31 (5.22)	-	0090** (0.027)	-	1.971 (5.142)	-	- 2.048 (5.108)
PFL (7)	0.008** (0.0006)	0.013 (0.0005)	-	0.010** (0.0006)	0.013** (0.0005)	0.014** (0.0006)	0.014** (0.0006)
APFL (8)	- 3.02 (5.22)	-	-	0.313** (0.018)	- 0.428 (7.288)	-	0.364 (7.288)
Coefficient of determination.(%)	25.89**	50.61**	36.02**	36.13**	50.62**	51.43**	51.43**

*(Figures within parenthesis are respective standard error, ** P< 0.01)*

Table 4. Prediction of herd life profit from first lactation traits by linear milk production function.

Combination of indipendent variables	6,7,8	4,5,7	2,3,5,6	1,2,3,7,8	3,4,5,6,7,8	1,2,3,4,5,7	1,2,3,4,5,6,7,8
Point of intercept	10262.43	- 14699.06	34119.63	7934.74	- 16345.95	- 6501.16	- 10171.56
Partial regression coefficients							
AFC (1)	-	-	-	- 61.83 (39.23)	-	- 86.00* (37.65)	- 86.51* (37.67)
WFC (2)	-	-	- 71.88** (6.74)	- 11.92** (3.96)	-	- 5.06 (3.83)	- 5.07 (3.84)
FLP (3)	-	-	- 16.99 (11.27)	31.50** (4.92)	- 14.12* (6.19)	- 15.44** (6.13)	- 14.64* (6.19)
FCI (4)	-	39.36** (2.57)	-	-	50.23** (7.17)	42.80** (3.17)	49.92** (7.18)
FLMY (5)	-	0.042 (0.59)	- 4.70* (1.83)	-	- 2.08 (2.11)	0.09 (0.61)	- 2.10 (2.11)
AFLMY (6)	-6204.601 (74576.36)	-	5984.40** (680.10)	-	- 36988.20 (70712.70)	-	- 32305.73 (70594.66)
PFL (7)	2.320** (0.037)	2.518** (0.378)	-	2.33** (0.038)	2.52** (0.003)	2.49** (0.03)	2.50** (0.03)
APFL (8)	3223.22 (53265.11)	-	-	- 1026.54** (181.80)	27106.32 (50474.24)	-	2384.07 (23804.07)
Coefficient of determination.(%)	71.38**	74.37**	13.97	72.31**	74.47**	74.57**	74.56**

*(Figures within parenthesis are respective standard error, * P <0.05, ** P< 0.01.)*

significant in all the combination while that of first lactation milk was significant for third combination only. Since sum the regression coefficients (elasticity of production) were either less than 1.0 or in minus, the empirical evidence in this study showed decreasing returns to scale i.e. increasing the above explanatory variables, the herd life milk production would decrease as explained by Cobb Douglas function. The value of R^2 of Cobb Douglas function was lower than that of linear function, therefore, it could be concluded that linear production function would be better than Cobb Douglas production function in prediction of herd life milk yield. The present finding was not in agreement with the result of Aul et al. (1974), Chhikara and Gangwar (1974), Singh et al.(1979) and Arora et al. (1994) who suggested Cobb Douglas production function would be better function.

PREDICTION OF HERD LIFE PROFIT IN BUFFALOES

To study the proportion of variation in total profit during herd life (total of three lactations) being explained by physical measurements viz. AFC, WFC, FLP, FCI, FLMY, AFLMY, PFL & APFL were considered by linear and Cobb Douglas form of milk production function. Results of linear production function of herd life profit *(table 4)* indicated that R^2 values obtained in seven different combinations (same as used for prediction of herd life milk yield) were significant indicating that about 71 to 74% of variation could be explained by all the combinations except combination number three. Incorporation of weight at first calving, first lactation period, first lactation milk yield and average milk yield per day of first calving interval (combination number three) could explain only 13.97 percent of variation in herd life profit. Between first lactation milk yield and first calving interval; first calving interval was found to be more important in predicting herd life profit because partial regression coefficient of first lactation milk yield were non-significant. It was as per expectation because expenditure during first calving interval would increase at faster rate than increase in return through first lactation milk yield.

The results of Cobb Douglas production

follows page 16 ☞

Table 5. Prediction of herd life profit from first lactation traits by Cobb Douglas function.

Combination of indipendent variables	6,7,8	4,5,7	2,3,5,6	1,2,3,7,8	3,4,5,6,7,8	1,2,3,4,5,7	1,2,3,4,5,6,7,8
Point of intercept	- 25.938	45.867	77.930	19.817	- 26.977	- 4.114	5.978
Partial regression coefficients							
AFC (1)	-	-	-	- 2.949** (0.916)	-	- 3.240** (0.904)	- 3.166** (0.908)
WFC (2)	-	-	- 10.882** (1.164)	- 4.790** (0.875)	-	- 4.117** (0.868)	- 4.127** (0.868)
FLP (3)	-	-	- 0.384 (1.420)	3.596** (0.809)	- 1.086 (1.042)	- 1.108 (1.032)	- 1.134 (1.032)
FCI (4)	-	3.724** (0.727)	-	-	-259.628 (283.49)	3.682 (0.626)	- 196.669 (280.412)
FLMY (5)	-	3.326** (0.607)	- 2.667 (1.359)	-	267.363 (283.459)	3.633 (0.626)	203.990 (280.374)
AFLMY (6)	- 79.258 (140.97)	-	11.261** (1.073)	-	- 212.982 (166.043)	-	- 170.139 (164.431)
PFL (7)	0.736** (0.018)	- 0.785** (0.019)	-	0.728** (0.019)	0.786** (0.019)	0.1761** (0.019)	0.761** (0.019)
APFL (8)	- 79.95 (140.96)	-	-	- 1.234* (0.537)	- 50.877 (235.338)	-	- 30.228 (232.64)
Coefficient of determination.(%)	52.47**	54.52**	15.60**	54.24**	54.59**	55.58**	55.61**

*(Figures within parenthesis are respective standard error, * P <0.05, ** P< 0.01.)*

function *(table 5)* indicated different trend of partial regression coefficient than that of linear function. Partial regression coefficient for age at first calving and weight at first calving were significant and negative in all the combinations indicating more importance of these traits in predicting herd life profit. But the values of R^2 estimated by linear regression were more than that by Cobb Douglas, though fallowed similar trends. Similar trends of R^2 were observed by Prasad and Manglik (1987) using linear and Cobb Douglas milk production function in crossbred cows. Thus linear production function is recommended for prediction of herd life milk yield or profit over Cobb Douglas function.

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COFA: THE ONLY DEDICATED MEDITERRANEAN BUFFALO STUD IN ITALY

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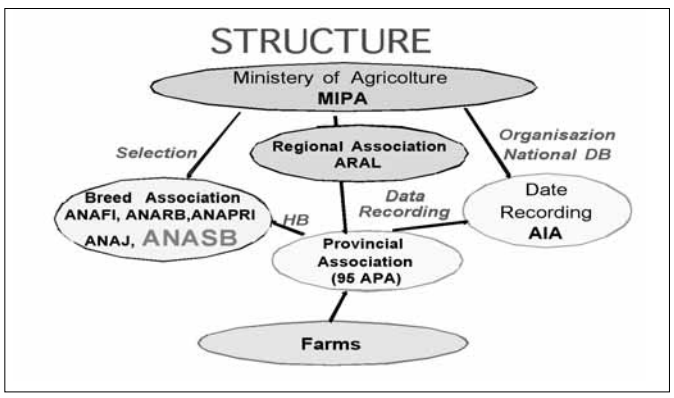
COFA STUD HISTORY

COFA, as an AI organization, has been active in the Italian AI world, thanks to its president, Arturo Casali, since 1974. Casali first as an importer, importing high quality genetics from the U.S.A. and later in 1985, as the promoter, investor and manager of an AI stud, is a well known figure in the Italian bovine industry. His Stud, situated in the large PO valley, in the northern part of Italy, first has produced a high quality line of Holstein sires but soon after has become known through its outstanding Mediterranean buffalos too.
The Water Buffalo with its enormous world population and its, up to now, small genetic development seemed to COFA an excellent opportunity to apply its know-how, acquired in years of work with the bovine species, a great challenge to improve the genetic ability of the buffalo species and a good opportunity to develop a new market. To work on this task COFA had the advantage to find in Italy one of the more productive breed in the water buffalo population and a breeder association that had developed the tools for a serious work of genetic evaluation and progress.

THE MEDITERRANEAN WATER BUFFALO

In Italy there are more than 320.000 buffaloes in 3.000 herds, with an increase of 14 % in one year. ANASB (Italian Buffalo Breeders Association) is in charge of the



ETTORE IT065800812386 from **Bellelli** Farm, Salerno Italy.
Typical Italian Mediterranean water buffalo housed in the Cofa stud

ANASB

(Associazione Nazionale
Allevatori Specie Bufalina)
National Breeders Association
of Buffalo Species

ANASB Core Services

- Herd Book management
- Genetic improvement
  1. Type classification and Shows
  2. Services for APA
  3. Services for A.I. Centre

ANASB Herd Book

- Management of buffalo breeders registrations
- Pedigree data management
- Publication of annual statistics
- Genealogical certifications
- DNA Bulls, Bulls' Dams
- DNA Daughters of Progeny Test
- Genetic Index Female Buffalos
- Genetic Index Bulls

ANASB Promotion

- Promote Italian water buffalo in Italy and abroad
- "La Bufala Italiana" magazine
- International Projects

ITALIAN SELECTION INDEX
Blup-Animal Model

$$PKM = Milk \times \frac{3{,}5 \times (\%\ Protein) + 1{,}23 \times (\%\ Fat) - 0{,}88}{100}$$

PKM = Production Kg Mozzarella

follows page 18 ☞

LUCKY da Izano IT019500348511 from **Massari** Farm
Cremona Italy

MOTHER BEST LACTATION

days	Milk Kg	Fat %	Protein %
270	4161	8,00	4,60

TORCINO IT061000104834 from **Vitale** Farm
Caserta Italy

MOTHER BEST LACTATION

days	Milk Kg	Fat %	Protein %
252	3913	8,70	4,60

herd book with 40.000 milking buffaloes registered and monthly controlled on their production. Average production in 270 days in Italy is 2469 kg with 8,40% fat and 4.70 % of protein.
The Genetic Herd book of the buffalo species has been created, by a Ministry decree, in 1980 and was kept by AIA (Italian Breeders Associations) until the year 2000. Then the MIPAF (the Ministry of Agriculture) gave the management of the Genetic Herd book to ANASB. The same year another decree recognized the registered buffalo as being part of its own buffalo breed called the Mediterranean Italian . The main characteristic of the Mediterranean Italian female buffalo is her productive capacity. In addition what is of foremost interest is that her productivity is demonstrable through her pedigree in which we can find productions (milk, fat and protein), type evaluation, and the genetic index of herself and her ancestors. This is possible since Italy is the only country in the world with a Genetic Herd book for the buffalo species, through which it is possible to program genetic progress thanks to progeny testing and the indexation of the animals through the method BLUP.

BELLE E PAPA' IT06500263360 from **Morese** Farm
Salerno Italy

MOTHER BEST LACTATION

days	Milk Kg	Fat %	Protein %
270	4225	8,60	4,80

ITALIAN BREEDERS ASSOCIATION

The National Breeders Association of Buffalo Species' (ANASB) main services are the management of the Herd book (registering new buffaloes and certifying their pedigrees), the creation of the selection index, the evaluation of genetic and type indexes, and the promotion of the Italian water buffalo in the world.
The Italian Selection Index or PKM, which stands for Production kg Mozzarella, is the primary tool for the selection of bull's dams and bull's sires. The PKM is purely a Production Index which is designed to select animals best suited for the production of milk for Mozzarella cheese, which is the only use of the Italian water buffalo's milk.

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COFA SELECTION SCHEME

Today, thanks to ANASB *(Fig. 1)*, which gets the lactations data from AIA (Italian Breeders Association), which collects them, and manages the evaluation and publishes the annual statistics, COFA is able to select on a population of 40.000 registered females buffaloes, every year, the best 1% to become bulls' dams. In addition, COFA gives great importance to the morphological characteristics, and in particular COFA's experts control bull's dams for udder conformation, feet and legs, and milking flow.
Out of every calf born in this restricted population, COFA selects 10 young bulls, which must have at least a pedigree of three generations, to be progeny tested. Of these at least three are expected to graduate to the top list for PKM and to become active bulls for the Italian and the export market in addition to become in due time bulls sires themselves.
Today almost all the most important herds in Italy work with COFA in young bulls selection, and COFA's goal is to work with as many herds as possible to promote in Italy as well as in the rest of the world the extraordinary value of the Mediterranean buffalo.

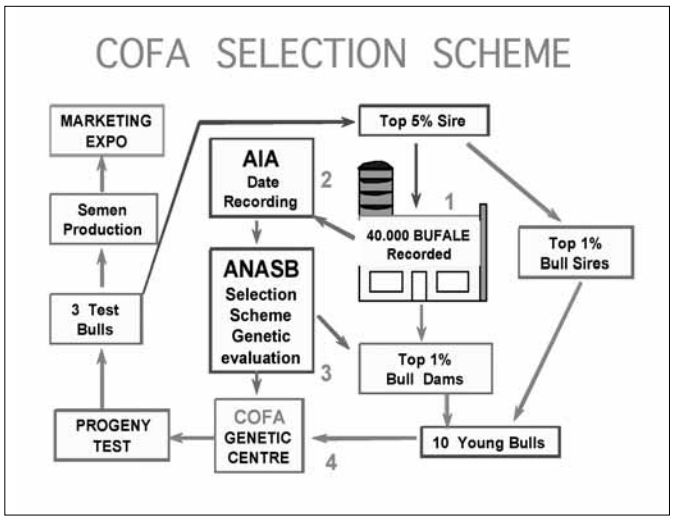

Fig. 1

COFA'S BARNS

A European Union regulation states that an AI stud must house in its premises only one species, and in fact COFA houses its Buffalo in special barns in a location separated from the Holstein bulls.
In the barns each bull is tied at its individual stand and fed corn silage ray grass hay, alfa alfa hay and concentrate. The beds are made of sawdust and the barns are cleaned and disinfected once a month.
The buffalo sires, before being put into production are kept in quarantine for 3-4 months in another stable and during this quarantine period they undergo several health tests to meet all the health requirements needed for semen production.
Thanks to all these attentions COFA is the only European Buffalo Stud authorized to produce by the European Union through the protocol number IT01bu.

SEMEN COLLECTION

The most important aspect of semen collection is the training of young sires. Training a young buffalo sire to the collection is often quite difficult because this species is very sensitive to people and therefore a lot of patience is necessary in this phase in order to avoid the animal quiet without risking to fail the collection itself.
The training and the collection takes place in the collection area with the help of other animals as teasers.
After the collection the semen is immediately transferred to the laboratory.
At COFA the buffaloes are collected twice a week with one or two ejaculates per day according to the demand of the semen or according to the productive capacity of the bulls.

SEMEN PROCESSING

To obtain good results during the insemination it is essential to produce semen of excellent quality.
COFA follows specific procedures for the handling of buffalo semen and thanks to this it is capable to obtain excellent results in the stables.
In COFA protocol for semen handling, in additional to the control of motility and semen concentration, a lot of importance is given to the morphological evaluation of the spermatozoa which is essential to evaluate their real insemination capacity. In additional, lot of attention is also given to the freezing phase.
At COFA special freezing curves are used

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and in some cases custom-made freezing curves are set up for each sire. The quality control after frosting is very strict and it is conduced with the aid of particular software which controls the progressive motility and concentration.

PACKAGING AND SHIPPING

After the quality control is finished the semen is kept in quarantine for 30 days and later it is stocked in special containers at a temperature of – 196° C.
COFA buffalo semen can be sent all over the world, the containers are held at COFA semen shop (legal headquarters for commercialisation) and are shipped with all due documents required by the importing country: health certificate, genealogical certificate or other.

HEALTH PROGRAM

To be able to ship the semen everywhere in the world COFA must follow a very rigid health control protocol, in fact all the sires in production must undergo the following health test every 28 days:
- Leucosis
- Brucellosis
- IBR sieroneutralization
- BVD sierological + virological
- Leptospirosis
- Blue Tongue
- Q Fever
- Campilobacteriosis
- Tricomoniasis

Every 3 months:
- Tuberculosis
- Paratuberculosis

All these tests are executed under the supervision of the local health authority (ASL), which is the local unit of the Health Ministry.

CONCLUSION

COFA mission is to lead in the development and marketing of superior livestock genetic products and services.
Cofa is committed to helping buffaloes producers maximize economic benefits by breeding animals of exceptional quality.

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