Buffalo Newsletter

Number 15 - February 2001

EUROPE - NEAR EAST

BULLETIN OF THE FAO INTER-REGIONAL COOPERATIVE RESEARCH NETWORK ON BUFFALO

INCLUDES SHORT COMMUNICATIONS, RESEARCH PAPERS, TECHNICAL NOTES, ONGOING RESEARCHES

From the editor

Several months have passed from the publication of the previous issue of the Buffalo newsletter, and we apologize with all readers for not having maintained the regular terms. Some of the readers, in fact, have inquired why they were not receiving any more this journal. The reason is that we have been very busy in organizing the "Joint FAO-ICAR Buffalo Workshop", announced in issue n° 13, that was finally held in May 2000, during the 32nd Biennial Session of the International Committee for Animal Recording. The participation of many people, mainly from developing countries, the interesting case studies that

follows page 2 ☞

INSIDE THIS ISSUE

BUFFALO GENETIC RESOURCES IN BANGLADESH

M. Omar Faruque

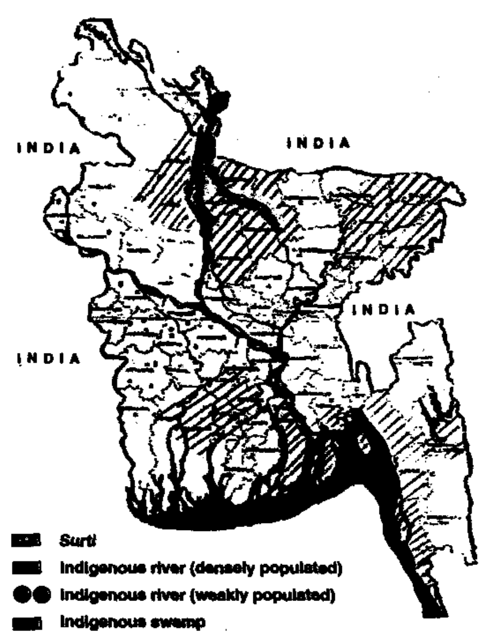
Bangladesh Agricultural University, Mymensingh, Bangladesh

e-mail: minnu@bdcom.com

Three main buffalo populations are reared in Bangladesh, each of them living in a specific area: two of them are of river type - the indigenous river buffalo and the Surti breed; one is swamp type and it is called simply indigenous swamp buffalo.
Their numbers are as follows:

Number animals	Indigenous river	Surti	Indigenous swamp
Total	433,200	4,500	37,500
Breeding males	3,600	115	600
Breeding females	152,956	2,820	12,375
% pure-bred females	80	90	40

Distribution of buffaloes in Bangladesh



GEOGRAPHICAL DISTRIBUTION

The indigenous river type of buffalo are found throughout all Bangladesh (figure 1); however, they are more concentrated in the western and central part, in particular in the Brahmaputra-Jamuna Flood Plain area and Ganges Tidal Flood Plain. The Surti breed is found in the north-western part of the country, in the Brahmaputra-Jamuna Flood Plain, crossed by the huge rivers Brahmaputra and Jamuna (fig. 2). The swamp buffalo of Bangladesh (fig. 3)

follows page 2 ☞

from page 1/From the editor

were presented, and the lively discussion that was carried out freely, for two days, among people of different countries, who work for the development and improvement of buffalo production, made the event really worth to be participated. You can read a brief report on the workshop in this issue of the newsletter. After the Workshop, we have been busy in preparing the relevant Proceedings, that have been published by ICAR-FAO in the form of ICAR Technical Series N° 4. The Workshop was an important milestone of the Buffalo Network, because it has proved that the international scientifical links favoured by the network can be made concrete by bringing together experts of different countries to work for a common project: the development and standardisation of milk recording in buffalo.
Again, I invite all readers of this journal not only to make their researches and experiences known through the Buffalo newsletter, but also to join the working groups and the implemented projects, so that international cooperation be most fruitful.

Prof. Antonio Borghese

from page 1/ BUFFALO GENETIC RESOURCES IN BANGLADESH

Fig. 1. A typical Indigenous River type buffalo cow.

Fig. 2. A typical Surti buffalo cow with calf.

Fig. 3. A typical swamp cow.

are found in the eastern and south-eastern part of the country, either in hilly or coastal areas. The hilly areas include the Great Sylhet, Chittagong and Chittagong Hill Tract districts, which are mountainous and covered by deep forests, marshy lands or lakes. The coastal area includes the Noakhali distric made of reclaimed sandy land in the Bay of Bengal, where forests and canals are abundant and are flooded by tidal saline water twice a day.

HISTORY

Indigenous river buffalo were introduced in different parts of Bangladesh through the process of animal domestication as well as human migrations from India. After the long natural selection, they are now considered native Bangladeshi type. They represent 60% of total buffaloes of the country. No breed standard exists for

follows page 5

Climatic characteristics of the areas where buffaloes are reared are described in the following table:

	NORTH-WEST	CENTRAL PART	SOUTH-WEST	NOAKHALI	SYLHET, CHITTAGONG, CHITTAGONG HILLS
Climate	Temperate	Subtropical	Subtropical	Subtropical	Subtropical
Soil	Noncalcareous -alluvium	Noncalcareous -alluvium; loam and sand	Noncalcareous s-grey and dark; clay; seasonally saline	Clay and sand	Sand; saline
Temperature	20.8-31 °C	26 °C	25.7 °C		
Humidiry		78.92 %	83.9 %		
Rainfall	139 mm	139 mm	270 mm		

this population; moreover, at present, continuous migration of river buffaloes from India and Nepal favour crossbreeding practices.
The Surti breed was introduced in the Brahmaputra-Jamuna Flood Plain from India 150 years ago. Recently, also for this breed crossbreeding with other breeds migrating from Nepal and India is occurring. Approximately 20% of this population is crossbred.
Indigenous swamp buffalo were introduced in the eastern and south-eastern parts of Bangladesh through the process of animal domestication as well as human migrations from Myanmar. The south-eastern part of the country was part of Myanmar before 1966. The north-east (Sylhet) was part of Assam before 1947. After the long natural selection, they are now considered native Bangladeshi swamp type. They represent 20% of total buffalo population of the country and do not belong to a standardized breed.


Fig. 4. An albino Indigenous River type cow.


Fig. 5. A typical Surti heifer.


Fig. 6. An albino swamp cow with calf.


Fig. 7. A buffalo cow feeding in the feeding trough by the homestead.

PHENOTYPE

Indigenous river buffalo have black colour at adult stage but brown when young; few albinoes are observed (fig. 4). They have curly medium or long horns; they are of medium size with broad head. Hossain and Ahmed (1968) observed an active growth of hair at the beginning of winter, the average number of hairs being 85.9 ± 0.03 per square cm. They measured the skin thickness the value of which was 5.53 ± 0.75 mm, the epidermis 0.08 ± 0.03 mm and the dermis 5.45 ± 1.02 mm. Values of haematological parameters for indigenous river buffaloes are the following: haemoglobin 10.37 g/cc; PCV 32.08 %; RBC 5.39 x10^6 /µL, MCV 59.6 µ, MCH 18.23 pg, WBC 7442 /µL (Hossein and Ahmed, 1968). Heart rate measured in beats/minute was 48; respiraton rate 16 and rectal temperature 100 F (Hossein and Ahmed, 1969a). Blood calcium was 6.95 mg/dl; chloride 441.95 mEq/L; creatinin 1.27 mg/dl; glucose 41 mg/dl and urea nitrogen 6.3 mg/dl (Hossain and Ahmed, 1969b).
Surti buffaloes are brown to light black in colour (fig. 5), have horns of medium size, with chevrons (14.4%), white tail switch (68.1%), white stockings (33.3%) and crescentic horns (5.7%).
Colour of the swamp buffaloes is grey to brown. White stockings and chevrons are present in animals of all ages and sex. Horns are medium or long sized and they are crescentic in shape. Animals are from small to medium size. Albinoes are observed (fig. 6). Phisiology of Surti and swamp buffalo in Bangladesh has not been studied yet.

HUSBANDRY

Indigenous river buffaloes are usually raised under semi-intensive system: animals are allowed to be fed roadside grass or grass from fellow land from morning to afternoon, covering a period of about 6 hours a day. They are fed paddy straw with or without rice bran at the homestead in the morning and evening (fig. 7 and

follows page 4 ☞

8). In some parts of the country they are kept on pasture on the sandy islands of rivers or sea, either during the dry season or throughout the year. This system is called "bathan", where animals are raised collectively, free and fed naturally grown grass (fig. 9). Wallowing is done during the grazing period, usually in the roadside ponds or rivers (fig. 10).

There is random mating among them while they are in "bathan". Most animals calve from July to August. On the other hand, animals kept on semi-intensive systems are subjected to controlled natural mating and calve during August to November. The length of the estrus cycle is 21.08 ± 3.46 days, with estrus period of about 24 hours (Hasnath, 1985; Hussain, 1990; Faruque, 1994, 1999).

In the western and central part of Bangladesh, number of buffaloes per household varies from 2 to 17; while in the southern and eastern part some household have up to 600 buffaloes.

Surti buffaloes are usually raised under semi-intensive as well as extensive management systems. During the dry season, they are kept on pasture on the sandy islands of the rivers Brahmaputra and Jamuna for about six months ("bathan"). In the wet season, animals are fed roadside grass during the day, paddy straw with or without rice bran in the morning. Most animals calve from August to November.

Indigenous swamp buffaloes are usually reared under extensive system in the hilly areas and in "bathan" of coastal areas. In hilly areas, animals are allowed to graze from morning to afternoon (fig. 11). In some parts they are kept on pastures on the sandy islands of the sea throughout the year (fig. 12). Wallowing is done during the grazing period usually in lakes or canals (fig. 13, 14). They are managed by cowboys and they are very docile to them (fig. 13). Most animals (all those who are in "bathan") calve from July to August; the ones which are semi-intensively raised, calve from August to November (Faruque, 1998; Faruque, 1999; Faruque and Amin, 1994). In the hilly areas of the eastern part of Bangladesh, as well in the south-eastern part, where buffaloes are semi-intensively managed, number of buffaloes per household is averagely 8.6. In "bathan" average number is 125 (Faruque, 1998; Faruque and Amin, 1995).

In all three types of buffalo populations, castration is done early in life for males, by the open method. Dehorning is done only for those adult buffaloes that need it. Artificial insemination is not practiced; culling of males and females is practiced on the basis of mass selection and pedigree, when available.

HEALTH

Occurrence of infectious diseases like FMD, HS, etc. is very rare in all buffalo populations maintained under semi-intensive system. It is more common in "bathan". Vaccination is not carried out on routine basis, but it is done at the time of the outbreak of the disease (Faruque, 1999). Incidence of liver fluke and round worm

follows page 6

Fig. 8. A group of buffalo fed on rice straw by the homestead.

Fig. 9. A buffalo herd grazing in the sandy island of bathan.

Fig. 10. A buffalo wallowing in the roadside pond.

Fig. 11. Swamp buffaloes grazing in the hill.

infestation are common (Faruque, 1998; 1999). The major cause of skin diseases is due to lice (Nooruddin and Dey, 1990). In Surti buffaloes, fascioliasis is very common; phosphorous and calcium deficiency occur during winter. Deficiency of manganese has been reported for swamp buffaloes. Abortion during mid and late pregnancy as well as still birth calves also occur. It was not established yet if these are caused by the high inbreeding or by venereal pathologies.

NUTRITIVE REQUIREMENTS

No real study on the nutrient requirements of buffaloes in Bangladesh were ever performed. A number of feeding system researches were done (Hakam and Rahman, 1977; Hossain, 1974; Faruque et al., 1982; 1986; Islam, 1989; Akbar and Tareque, 1990; Hossain, 2000. From these studies, it appears that feed quality has little influece on the production efficiency of indigenous buffaloes, in terms of growth and lactation yield; however, milk quality was influenced. Dry matter intake varies from 2 to 2.5% per 100 kg body weight.

follows page 6 ☞

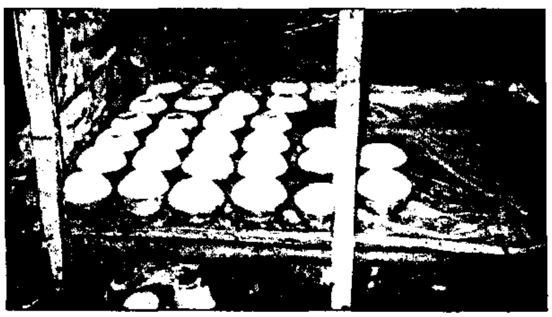


Fig 16. Soft cheese made traditionally from the buffalo milk.

PERFORMANCES

	Indigenous River	Surti	Indigenous Swamp
Growth rate kg (overall)	0.270	0.245	0.270
Age at maturity (months)	48	42	55
Body height male at birth (cm)	73	-	-
Body height mature male (cm)	123	-	-
Body height female at birth (cm)	72	70	72
Body height mature female (cm)	121	126	125
Lactation length (days)	275	272	240
Lactation milk yield (kg)	590	812	280
Fat %	7.1		
Protein %	4.6		
Weight at slaughter, males (kg)	379 ± 65		
Carcass yield %	42 ± 3		
Meat tenderness	Poor		
Weight weaned calf/female/year (kg)	122		

Fig. 12. Swamp buffaloes grazing in the sandy island.

Fig. 13. Swamp buffaloes wallowing in the canal.

Fig. 14. Swamp buffaloes grazing in the field after tidal wave of sea.

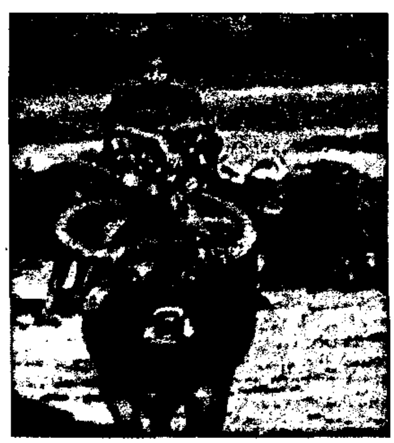


Fig. 15. A cowboy who controls the buffaloes.

PRODUCTS

Common dairy products are the following: milk, soft cheese, yoghurt. In the areas where the Surti breed is raised, also ghee is produced. Meat and skins are also used.
Milk of indigenous swamp buffaloes of the south-east is used along with milk of crossbred buffaloes to produce traditionally made yoghurt and soft cheese (fig. 16 and 17).

SOCIAL ASPECTS

Buffaloes are being kept by the owners because their ancestors raised buffaloes. Buffalo milk is sold at higher price than cow milk.
Indigenous swamp buffalo are raised primarily for draught purposes, whereas milk and meat are of secondary importance. An adult indigenous river buffalo costs US dollars 350 (while a cow costs 200). Yearly net profit of a farmer from the sale of the milk of one buffalo (producing 2 kg milk/day) is US dollars 200. An adult Surti buffalo on the other hand costs US dollars 400, and produces 3 kg milk/day.

Fig. 17. Yoghurt made from buffalo milk is being sold in the market.

SELECTION PROGRAMMES

The Government of Bangladesh has initiated a crossbreeding programme on the indigenous river buffaloes, by distributing Nili-Ravi bulls produced in the Bangladesh Buffalo Breeding farm, located in the southern part of the country. However, there is no follow-up of this programme because the progeny is not recorded. Moreover, the Nili-Ravi bulls are not progeny tested, but simply selected at mass level.
The Government of Bangladesh has also initiated a crossbreeding programme on the indigenous swamp buffaloes, by distributing Nili-Ravi and Murrah bulls from 1960 in the south eastern areas.
The Bangladesh Agricultural University of Mymensingh intends to implement milk recording systems for buffalo on the field. For this reason, several studies were carried out during the past 10 years in order to define the best system fitting the production and social conditions of Bangladesh farmers (Faruque, 2001 a; 2001 b).

REFERENCES

AKBAR M.A. AND TAREQUE A.M. (1990). Utilization of by-products and locally available feedstuff in buffalo ration in Bangladesh. Proc. Final research coordination meeting on the use of nuclear techniques to improve omestic buffalo production in Asia. Phase II, Australia, pp. 63-74.

FARUQUE M.O. (1994). The indigenous buffaloes in the Mymensingh district of Bangladesh. Buffalo J., 10:91-100.

FARUQUE M.O., HASNATH M.A. AND HASAN N. (1982). The effect of different levels of urea in ration on the rumen metabolism of male buffalo calves of bangladesh. Bang. J. An. Sc., 11:52-59.

FARUQUE M.O., HASNATH M.A., MOSTAFA K.G. AND MIAH M.M. (1986). Partial replacement of protein by urea molasses in concentrate mixture fed to buffalo. Indian J. Animal. Sci., 56:1104-1106.

FARUQUE M.O. (1998). First annual report on the identification of best genotype of buffaloes for dairy purpose in Bangladesh and to improve their productivity. Bangladesh Agriculture University, Mymensingh

FARUQUE M.O. (1999). Second annual report on the identification of best genotype of buffaloes for dairy purpose in Bangladesh and to improve their productivity. Bangladesh Agriculture University, Mymensingh.

FARUQUE M.O. AND AMIN M.R. (1994). Indigenous buffaloes in the coastal area of Bangladesh: distribution pattern and genotypes. Bangladesh J. Training and Development, 7:83-88.

FARUQUE M.O. AND AMIN M.R. (1995). Indigenous buffaloes in the coastal area of Bangladesh, part II: productivity in the south-western coastal area . Bangladesh J. Training and Development, 8:138-140.

FARUQUE M.O. (2001 a). Buffalo Breeding in Bangladesh. In Workshop on Animal recording for Improved Breeding and Management Strategies for Buffaloes. ICAR Technical Serie No. 4, pp. 51-54.

FARUQUE M.O. (2001 b). Development of a record keeping system for genetic improvement of village milk buffaloes in Bangladesh: a case study. In Workshop on Animal recording for Improved Breeding and Management Strategies for Buffaloes. ICAR Technical Series No. 4, pp. 55-60.

HAKAM M.M. AND RAHMAN S.M. (1977). Groundnut oilcake in lactating buffalo rations. Bang. J. An. Sc., 7:12-17.

HASNATH M.A. (1985) Breeding, feeding and management o water buffaloes in Bangladesh. Proc. 3rd WAAP Congress, Seoul, Vol. I:70-79.

HOSSAIN A.S.K.E. AND AHMED S.U. (1968). Haematological values for normal buffaloes in East Pakistan. Agricultural University Dairy farm. Pak. J. Vet. Sc., 2:126-133.

HOSSAIN A.S.K.E. AND AHMED S.U. (1969a). A preliminary study of normal temperature of the buffalo in East Pakistan. Pak. J. Vet. Sc., 3:12-16.

HOSSAIN A.S.K.E. AND AHMED S.U. (1969b). Studies on the pulse rate and respiratory frequency in buffaloes. Pak. J. Vet. Sc., 3:61-64.

HOSSAIN A.S.K.E. (1974). Effect of feeds on the composition of milk of local buffaloes. MSc. Thesis, Bangladesh Agricultural University, Mymensingh.

HOSSAIN A.S.K.E. (2000). Study on the milk yield and composition of buffalo under extensive management system. MSc. Thesis, Bangladesh Agricultural University, Mymensingh.

HUSSAIN M.S. (1990). Performances of individual buffaloes in Tangail district. MSc. Thesis, Bangladesh Agricultural University, Mymensingh.

ISLAM S.M.A. (1989). Effects of different methods of urea incorporation in rice straw based diets on intake, feed digestibility and growth rate of buffalo heifers. MSc. Thesis. Bangladesh Agricultural University, Mymensingh.

NOORUDDIN M. AND DEY A.S. (1990). Further study on the prevalene of skin diseases in domestic ruminants in Bangladesh. Bangladesh Veterinarian, 7:75-81.

PREDICTION OF LACTATION YIELD FROM LAST-RECORD DAY AND AVERAGE DAILY YIELD IN NILI-RAVI BUFFALOES

Muhammad Sajjad Khan and Haroon Zaman Chaudry

Department of Animal Breeding and Genetics, University of Agriculture, Faisalabad 38040, Pakistan

INTRODUCTION

Lactation curve in buffaloes behaves similar to that in cattle. A standard lactation of ten months is also defined similar to that in cattle and procedures of estimating lactation milk yield are likely to be similar in both the species. Records shorter than the standard lactation are used to reduce the bias in estimating breeding values of sires due to differences in the culling rates among the progeny groups. Early estimates of sire's breeding values by extending lactations in progress can also help reduce the generation interval as well as increase the intensity of selection. These projected records can be used to estimate milk yield of a buffalo while her lactation is still in progress. This early information can facilitate the farmer to decide if she should be kept for producing the offspring. Furthermore, it helps in the allocation of resources such as feed supplies both for an individual cow or a herd.

To improve the genetic potential of Nili-Ravi buffaloes, genetic improvement programs are underway in Pakistan. The data on milk production and other economical traits are being collected and milk production records are adjusted for shorter lactation length. Lactations abandoned for abortion and sickness are, however, excluded from analysis considering them 'abnormal'.

Lactation length adjustment factors for buffaloes have usually been developed from simple or multiple regression procedures using lactation length. As the current recording systems do not require that last test day yield be available for every lactation, a cut off is generally assumed, beyond which milk yield is considered as from a normal lactation. The usually assumed cut-offs range from 60 to 180 days (Cady *et al.*, 1983; Khan, 1986). Limits of 100 or 150 days are also common (Salah-ud-Din, 1989). Lactation records between the minimum days in milk (DIM) and the selected point, such as 305 days, are thus considered as the genetic potential of the buffalo and are not corrected for lactation length (Khan, 1986). The last test day adjustment procedure has previously been suggested (Khan, 1997) as it was found to be more accurate (Iqbal, 1996) than the other procedures in vogue. The procedure involves prediction of lactation yield from last record to the end of standard lactation (305 days) but does not account for differences in high and poor yielders with similar last test day yield. Present study was planned to compare different procedures of adjustment and see if prediction of lactation milk yield using last record day information could be improved by using information on the average daily milk yield of the recorded lactation.

MATERIALS AND METHODS

Milk yield records of 993 Nili-Ravi buffaloes, maintained at Livestock Experiment Station, Bahadurnagar, Okara from 1970 to 1997 were used for the present study. Weekly milk yield on 2704 lactations of these buffaloes were available with lactation length of at least 60 days. If milk yield was missing for any week, it was estimated by averaging previous and next available weekly record. However, if milk yield information was missing for more than eight weeks (56 days) consecutively, such records were excluded. Errors in data entry were minimized by deleting outliers and allowing a maximum of 100% increase or decrease between two consecutive weeks. Season of calving was defined as Summer (April to September) and Winter (October to March). Following five types of adjustments for adjusting shorter lactations to 308-day yield were considered.

a) Milk yield adjusted by using a simple regression equation proposed by Khan (1986). Adjusted milk yield using this simple linear regression was named as MYSRF.

b) Milk yield adjusted by using factors calculated on the basis of last test day procedures (Iqbal, 1996). All lactations of (308 day duration were used for the calculation of future milk yield factors and the adjusted milk yield was called MYATYP. In this adjustment procedure 308-day milk yield was estimated using last test day yield information (milk yield of morning and evening milkings added together on the last week). The 308-day milk yield was estimated as sum of actual yield for the known/recorded lactation period and predicted yield for the remaining period (308 minus days in milk). The predicted yield was calculated by multiplying future daily milk yield (estimated from a regression equation having lactation length as a predictor along with the intercept) with days in the remaining period.

c) Milk yield adjusted by using factors calculated on the basis of last test day procedures, similar to b) above but excluding lactations that were atypical. A gamma-type

follows page 8 ☞

function (Wood, 1967) was used as follows to decide for atypical lactations. Lactations were declared as atypical if there was a decline in milk yield after calving, instead of an increase or if there was an increase after the peak instead (Khan and Gondal, 1996). There were 253 such lactations leaving 2451 lactations to be used for the development of regression equations. The factors developed were used to estimate 308-day milk yield and the estimated lactation milk yield variable was named as MYTP1.

d) To utilize short lactations (< 308 days) a ratio of the milk yield to be estimated and last test day yield was obtained [ratio = (308-day milk yield - milk yield for recorded lactation) / last test day milk yield] from the 308-day complete lactations and 308-day yield was estimated for the short lactations. This made it possible to estimate future daily yield and the regression equations could be developed from all the data set to predict future daily yield and then the 308-day yield. The predicted 308-day yields were called MYTP2.

e) To account for variation in the behavior of lactation curves for low and high producing animals with a similar last test day yield, regression equation to predict future daily milk yield was modified. Future daily yield for the short lactations was not only predicted from the last test day yield available (Iqbal, 1996; Akram, 1997) but average daily yield of the known part of the lactation was also utilized i.e., to predict future daily yield, as in b) above, there was an intercept and two predictors. The 308-day milk yield was then predicted as described above and the predicted 308-day milk yield was named as MYTP3. The regression analysis was done by SAS (1990).

RESULTS AND DISCUSSION

Out of 2704 lactations having more than eight weeks of duration, 59.2% had lactations shorter than 44 weeks of duration (Table 1). If minimum was increased from 8 to 16 weeks, this included 3.0% of all the lactations. Buffaloes with lactations of more than six months duration (>182 days) were 89.2% of the data set. It may be mentioned that lactations with lactation length (LL) of less than 2 months (56 days) were not included in the data set and the values in the Table 1 do not represent population averages. Such lactations were less than 5% of the total lactations included in the study period.

Shorter lactations had lower milk yield as compared to the complete or longer lactations (Table 1). Milk yield averaged 1984.4 ± 773.43 kg when information up to 44 weeks was used. Lactation length for these records averaged 266.6 ± 55.15 days. Average lactation length of these records was 289.6 ± 82.12 days. Very short lactations (8-11 weeks) had average milk yield of 347.1 ± 148.53 kg. A visual appraisal of first and later parities for different lactation length revealed different behavior. It also indicated that most of the lactations with shorter lactation duration were complete as the animals dried gradually. There were 253 atypical lactations (9.4% of total number of lactations) with a range from 0.4% (in 6th and 7th parity) to 2.7% (in first parity). About 70% of the atypical lactations fell in the first three parities while rest of the 30% in the later parities. Considering that such a behavior was due to some physiological or environmental factors (disease incidence , seasonal influences, mistakes in recording, routine or occasional suckling by the

follows page 9

Table 1. Frequency distribution of lactations by lactation length and averages of milk yield and lactation length.

Lactation length (weeks)	N	%	Lactation length (days)	Milk yield (kg)
8-11	30	1.1	75.0 ± 12.00	347.1 ± 148.53
12-15	51	1.9	106.1 ± 24.82	549.1 ± 186.50
16-19	56	2.1	133.0 ± 25.40	704.0 ± 174.89
20-23	79	2.9	160.6 ± 19.41	858.0 ± 287.64
24-27	98	3.6	184.6 ± 14.21	1066.3 ± 308.29
28-31	207	7.6	213.0 ± 11.12	1326.7 ± 355.36
32-35	270	10.0	239.5 ± 14.39	1694.6 ± 471.03
36-39	422	15.6	267.8 ± 09.26	1954.2 ± 503.18
40-43	389	14.4	294.4 ± 08.30	2198.2 ± 622.37
≥ 44	1102	40.8	307.0 ± 08.07	2453.5 ± 618.78
OVERALL	2704	100.0	266.6 ± 55.15	1984.4 ± 773.43

calves etc), prediction equations were developed both by including and excluding such lactations After establishing that the lactations of different duration behaved differently and that about 10% of the lactations did not behave as expected, regression equations were developed for adjusting lactations to a standard lactation length of 44 weeks (308-days) using the last test day information. Predicted yields were calculated both by including (MYATYP) and excluding (MYTP1) atypical lactations. Milk yield using the correction factors developed by Khan (1986) and currently being used were also predicted (MYSRF) and prediction equations developed. The coefficients of equations for MYTP1 were slightly different from those reported by Iqbal (1996) because atypical lactations were excluded in developing them and also because interaction of last test day with LL was not included in model as suggested by Akram (1997). Intercept decreased while regression of milk yield on last test day yield increased as lactation length increased. Coefficient of determination was better towards the end of the lactation as compared to prediction when weeks in lactation were smaller. When lactations initiated in Winter, intercepts were higher but slopes were lower as compared to those initiated in Summer. This was true for first as well as greater parities. For MYTP2, where complete data set had been used for prediction from last test day milk yield, intercept coefficients were reduced and regression coefficients increased. When average daily yield was added as a predictor of future yield (MYTP3), intercepts further reduced and regression of future daily milk yield on last test day yield also decreased because of inclusion of another predictor. Coefficient of determination improved by almost 1%.
The extended yields were statistically different from the actual lactation milk yield of 1984.4 kg for an average lactation length of 266.6 days (yield beyond 308-days excluded). Extended yields were higher on the average (2122.9 to 2139.7 kg) as compared to the actual milk yield because of extrapolation to 308-days. The difference between actual and predicted gradually reduced with increased lactation length. Simple linear regression procedure overestimated the later half of the lactations as compared to the prediction by last test day procedure because of assuming that milk yield increased at a constant rate throughout the lactation. Such a procedure is likely to underestimate lactation yield for earlier part of the lactation curve when actual rate of increase is higher than estimated from a linear regression procedure. Khan (1996) used an Animal Model to estimate regression coefficients by simultaneously adjusting for age at calving but predicted lactation curves had increasing trend even towards the end of lactation curves. It was thus suggested that calculating regression coefficients from such information would be less accurate. Iqbal (1996) declared that the last test day procedure was more accurate as compared to other prediction procedures for Nili-Ravi buffaloes. Predicted milk yield was generally higher (except for 8-11 week of lactation length) when prediction equations included all the records (MYATYP) as compared to using typical lactations only (MYTP1). Difference between MYATYP and MYTP1, however, was small and reduced to almost zero for

follows page 10 ☞

Table 2. Standard deviation (SD) of bias and correlation (predicted, actual) between actual and predicted lactation yield using different adjustment procedures.

Lact. Length	Standard Deviation of Bias			Correlation bet. predicted & actual yield		
(weeks)	MYTP1[1]	MYTP2[2]	MYTP3[3]	MYTP1[1]	MYTP2[2]	MYTP3[3]
8	308.9	379.5	372.6	0.867	0.838	0.844
12	264.8	325.3	318.8	0.904	0.882	0.887
16	223.8	272.1	266.2	0.933	0.916	0.920
20	188.7	227.0	221.6	0.953	0.941	0.943
24	155.3	178.9	174.8	0.969	0.962	0.963
28	123.9	140.8	137.5	0.980	0.975	0.976
32	92.0	103.6	102.3	0.989	0.986	0.986
36	58.1	63.9	63.2	0.996	0.995	0.995
40	27.8	29.2	28.8	0.999	0.999	0.999
43	7.3	7.0	6.9	1.000	1.000	1.000

[1] Prediction equations based on last test day procedure; only typical lactations of ≥ 308 days duration were used in calculations. [2] Prediction equations based on last test day procedure; only typical lactations of ≥ 56 days duration were used in calculations. [3] Prediction equations based on last test day procedure but having daily milk yield also; only typical lactations of ≥ 56 days duration were used in calculations.

lactations with longer lactation length. So the variable MYATYP was dropped for further analysis.
When shorter lactations were included for developing prediction equations, predicted milk yield (MYTP2, MYTP3) was lower as compared to predicted milk yield from equations using lactations with ≥ 308 days of duration (MYTP1). This was especially true for shorter lactation length groups. Predicted milk yield for 8-11 weeks lactation length group was 1417.1, 1137.4 and 1099.1 kg for MYTP1, MYTP2 and MYTP3, respectively. The difference among the three variables, however, reduced for higher lactation length groups. The standard deviation of bias and correlation between actual and predicted lactation milk yield indicate (Table 2) that inclusion of average daily milk yield as a predictor along with the last test day milk yield was a better choice when all lactation records were used (MYTP2 vs. MYTP3). It decreased standard deviation of bias and improved the correlation between actual and predicted milk yield. Lower values of bias and better correlation between actual and predicted milk yield for MYTP1 were because complete lactations were used only.
The credit given to any buffalo with different last test day yield and average daily yield of known lactation period was calculated. For different last test day milk yields, credit given to a lactation of certain length was different. At 56 days of lactation, for example, credit for MYTP1 would be 903 kg when last test day milk yield was one kg while this credit for MYTP2 would be 401 kg. Credit decreased as lactation length would increase. At 280 days for a last test day milk yield of 5 kg, credit would be 135 and 123 kg for MYTP1 and MYTP2, respectively. The credit given to a lactation of 56 days would be 280, 401, 522, and 643 kg, respectively for average daily milk yield of one, three, five and seven kg when last test day milk yield was one kg. The credit for the unknown (unrecorded) lactation did not depend on the last test day milk yield only but also on the performance of the animal for the known part of the lactation. Thus even if animal dried naturally or if the reason of drying were unknown (as was the case for most of the data), extending such lactations by equations used for MYTP3 credited or discredited the animals appropriately. Using last test day information alone would over adjust the poor yielders. Last recorded milk yield information along with average daily yield of the recorded lactation period are suggested to be used for standardization of milk yield data in Nili-Ravi buffaloes.

CONCLUSIONS

Comparison of different procedures of lactation milk yield adjustement from partial/incomplete or completed lactations indicated that in Nili-Ravi buffaloes milk yield averaged 1984 ± 773 kg with lactation length of 290 ± 82 days. Very short lactations of 8-11 weeks had average milk yield of 347 ± 149 kg. Milk yield predicted from a linear regression equation, or from last test day information was higher as compared to actual milk yield due to extrapolation to a higher base. Simple linear regression procedure overestimated the yield in the later part of the lactation curve. Most precise adjustments were obtained when last test day and average daily milk yield information were included as predictors. The standard deviation of bias decreased and correlation between actual and predicted lactation milk yield improved with inclusion of average daily milk yield as a predictor along with the last test day milk yield. Last recorded milk yield information along with average daily yield of the recorded lactation period are suggested to be used for standardization of milk yield data in Nili-Ravi buffaloes.

ACKNOWLEDGEMENTS

The Director, Livestock Production Research Institute, Bahadurnagar (Okara) is thanked for his permission to use the data. The computational and other facilities of PARB funded project "Improvement of Productivity of Sahiwal Cattle and Nili-Ravi Buffalo Bulls Through Development of Efficient Milk Recording System for Progeny Testing" are gratefully acknowledged.

REFERENCES

AKRAM, M. (1997). Genetic and phenotypic aspects of diurnal variation in milk yield of buffaloes. M.Sc. Thesis., Dept. Anim. Breed. Genet., University of Agriculture, Faisalabad.

CADY, R.A., SHAH, S.K, SCHERMERHON, E.C. AND MCDOWELL, R.E. (1983). Factors affecting performance of Nili-Ravi buffaloes in Pakistan. Journal of Dairy Science 66:578-286.

IQBAL, J. (1996). Sire evaluation on partial lactation records in Sahiwal cattle and Nili-Ravi buffaloes. Ph.D. Thesis, Dept. Anim. Breed. Genet., University of Agriculture, Faisalabad.

KHAN, M.A. (1986). Genetic analysis of a purebred herd of Nili-Ravi buffalo. Ph.D. Thesis, Dept. Anim. Breed. Genet., University of Agriculture, Faisalabad.

KHAN, M.S. (1996). Adjustment of milk yield for lactation length in Nili-Ravi buffaloes. Pakistan Journal of Agricultural Sciences 33:77-81.

KHAN, M.S. (1997). Predicting lactation milk yield from last test day yield in buffaloes. Buffalo Bulletin. 16(4):78-80.

KHAN, M.S. AND GONDAL, K.Z. (1996). Factors affecting lactation curve of Nili-Ravi buffaloes. In: *Proceedings of National Seminar, Statistical Application in Agriculture and Industry*. University of Agriculture, Faisalabad, pp 55-59.

SALAH-UD-DIN. (1989). The genetic analysis of production and reproduction traits in Nili-Ravi buffalo in Pakistan. Ph.D. Diss., The Ohio State University, Columbus (U.S.A).

SAS/STAT®.(1990). Useris Guide, Version 6. SAS Inst., Inc., Cary, NC. USA.

WOOD, P.D.P. (1967). Algebric model of the lactation curve in cattle. Nature (London) 216:164-166.

A STUDY ON EFFECT OF SEASONS ON MILK PRODUCTION AND CALVING PATTERN IN NILI RAVI BUFFALOES

S. Hassan Raza, A. Iqbal, M.S. Khan and A. Ali

Dpt. Livestock, University of Agriculture, Faisalabad, Pakistan

ABSTRACT

Although buffaloes are not seasonal breeder, they do show seasonality in breeding and calving which ultimately results in shortage of milk in summer, when its demand is at peak. To investigate the effect of different seasons on traits of economic importance in dairy buffaloes, this study is conducted. The data on five years (1983-1987) regarding calving, milk production and breeding in Nili Ravi buffaloes, maintained at the Livestock Experiment Station, University of Agriculture, Faisalabad were collected and statistically analyzed. It was inferred that seasons have significant (P<0.01) effect on calving pattern, milk production and occurrence of heat in dairy buffaloes. Maximum calving took place in autumn (45.29 %) and minimum in winter and spring (5.66 %) in each case. The highest values for milk production were observed in autumn (25,528 l.) and lowest in summer (14,507 l.). Out of the total, about 48% buffaloes exhibited heat in winter and only 2.39 % in summer. These revealed that severe summer season adversely impairs the reproductive efficiency of the lactating females. Through adoption of certain managemental practices, this effect of heat stress can be minimized to alleviate the situation for the improvement in milk supply.

INTRODUCTION

Generally buffaloes are not considered seasonal breeder but they show seasonality, which is a major problem in regular supply of milk throughout the year. It seems that buffalo has partially freed herself from the seasonal effects. There are many factors, which affect the estrous cycle of the females and libido/semen production of males during summer and make them seasonal breeder (Rife, 1959; Cockrill, 1974). In Pakistan buffaloes are bred from October to December, when day length is decreasing. Seasonality in breeding may be due to anestrous or silent heat during the hot and dry months of summer (Shah et al., 1994). Milk yield in buffaloes is also affected adversely during summer. Reduction in heat stress and its effects by splashing water on their bodies during summer season was noted to boost up milk production . Estrous cycle in females is affected by plan of nutrition, length of the daylight and ambient temperature. Evidences show that high ambient temperature directly affects the sexual cycle of females. Few incidences of estrous were observed in hot months and furthermore, symptoms of estrous if found were not pronounced during the adjacent periods (Williamson and Payne, 1990). A study was planned to evaluate the effects of different seasons on productive and reproductive traits in dairy buffaloes under farm conditions where better and improved management conditions were available.

MATERIALS AND METHODS

The data of five years (1983 - 1987) on milk production, calving pattern and occurrence of estrous, during different seasons and calving pattern in buffaloes kept at the Livestock Experiment Station, Department of Livestock Management, University of Agriculture, Faisalabad were collected. The year was distributed into four seasons namely spring (February - April), summer (May - July), autumn (August - October) and winter (November - January). The data on average milk production, calving and incidences of estrous during five years were distributed in different seasons. The data collected were subjected to statistical analysis using the techniques described by Steel and Torrie (1980) to determine the level of significance of effects of seasons on above parameters.

RESULTS AND DISCUSSION

1. MILK PRODUCTION

Results given in table 1 show that the highest milk production was found in autumn (25,528 l.) and the lowest in summer (14,507 l.). Statistical analysis revealed that season had a significant effect on milk production. Duncan's Multiple Range Test was used to compare the

Table 1: Average Milk Production During Different Seasons (%).

SEASONS	MILK PRODUCTION (L.)	MILK PRODUCTION (%)
Spring	16333 ab	21.23
Summer	14507 a	18.85
Autumn	25528 c	33.18
Winter	20552 bc	26.71

follows page 12 ☞

differences between means. Differences were non-significant between means for spring and summer; spring and winter; autumn and winter.
Fig.1 shows the percentage of milk produced during different seasons. There is substantial increase in milk demand during hot season because of its extra use in different summer drinks. This increase in consumption coupled with low production ultimately affects the milk price and consumers have to pay maximum price during this period. The high price of milk seriously hits the low and medium income groups of the society. At the end of summer production started to increase and reached at the maximum, retained its persistency for a short period in winter and then showed a declining trend (Fig 1).
The increase in milk production in autumn was due to the higher calving percentage, augmentation in number of animals in milk and alleviation from the summer heat stress. In summer high ambient temperature adversely affects animal production especially in case of buffaloes by restricting the feed intake and resulting in huge drop in animal production. These findings are in accordance with those of Misra *et al.* (1963) and Williamson and Payne (1990). These results are also supported by Aliev (1961) who stated that during summer, when temperature reached 40-45 °C, abomasal secretion lost its digestive activity, which resulted in reduction in feed consumption and milk production. The data collected on calving were subjected to analysis and revealed that effect of season on calving was highly significant (P<0.01). Second reason for increase in milk production during autumn is the high calving percentage in July and August. These animals reached their peak production in autumn and this effect is revealed in high milk production in this period of the year (Fig. 1). In addition, owing to the alleviation of heat stress in autumn, they express their potential more efficiently.

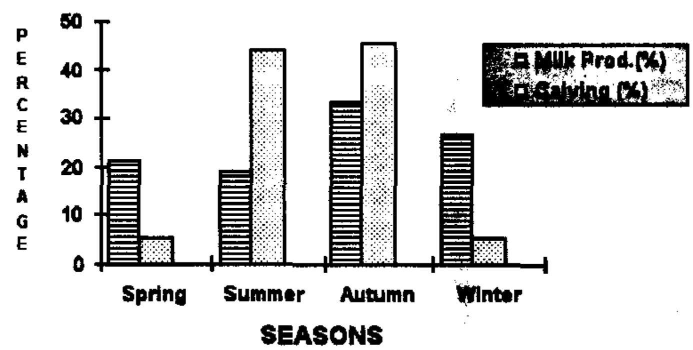


Fig. 1 - Milk production and calving (%) in different seasons.

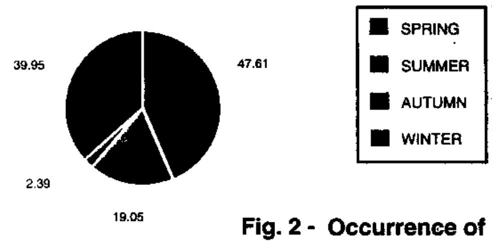


Fig. 2 - Occurrence of heat during different seasons (%)

2. Calving and Occurrence of Heat during Different Seasons

The statistical analysis of data showed a significant (P<0.01) effect of seasons on calving. Maximum number of calvings took place in autumn season (45.28 %) and minimum in spring and winter (5.66 %) as shown in Figure 1. These results are supported by those of Goswami and Nair (1965) and Gopalakrishnan and Lal (1985); they reported the highest calving percentage during autumn. Results of this study showed that a significant number of buffaloes came in heat during winter and conceived in this period, and ultimately calved in autumn. To prove this fact, when data were analyzed, Fig. 2 indicates that a high number of buffaloes (47.61 %) showed estrous signs in this period and a minimum number (2.39 %) in summer. Majeed *et al.* (1966) also reported that in Pakistan appearance of estrous in buffaloes was maximum during October to December. These findings are strengthened by the work of Gopalakrishnan and Lal (1985), who reported that 31.25, 28.95, 17.03 and 22.77 percent buffaloes showed heat during winter, autumn, summer and spring seasons, respectively. This trend of calving forces the human population to face the milk shortage during summer season when its demand is at the highest level. If buffaloes come in heat in summer, ultimately they will calve in late spring and early summer. This calving pattern can be of

follows page 13 ☞

great help in overcoming the shortage of milk. The scarcity of fodder impaired with reduced nutrients digestibility and low feed intake result in reduction in milk production during summer. These factors also show their adverse effect on the reproductive efficiency in both sexes. Furthermore, it is a well-established fact that high ambient temperature and heat stress impairs the breeding efficiency in both sexes. In males, heat stress will cause low fertility, poor quality of semen and lack of libido, while in case of females short and nocturnal estrous period with vague symptoms and absence of mucus discharge is found (Cockrill, 1974).

Day length also influences the breeding efficiency of females. In Pakistan buffaloes breed from October to December when day length is decreasing. The stimulus for reproduction during certain seasons results from the action of light via the optic nerves on the pituitary gland. This stimulus causes the pituitary to release gonadotropic hormones that activate the functioning of the gonads. In severe summer, with increased day length, a disengagement of the pituitary-thyroid axis occurs which causes silent heat (Shah *et al.*,1994).

Milking at Okara (Punjab).

LITERATURE CITED

ALIEV, A.A. 1961. Effect of high environmental temperature on secretions by abomasal glands in buffaloes. Fiziol.ZI. USSR, 47:1156-1162.

COCKRILL, W.R. 1974. The Husbandry and Health of the Domestic Buffalo. Ist.Edi. F.A.O.,Rome, Italy.

GOPALAKRISHNAN, C.A. AND G.M.M. LAL. 1985.Livestock and Poultry Enterprises for Rural Development. Vani Educational Books, Delhi, India.

GOSWAMI, S.B. AND A.P. NAIR. 1965. Studies on "off season calving" of the Indian water buffaloes. II.Indian J.Dairy Sci., 18:104-108.

MAJEED, M.A., A.W. QURESHI AND M.A. TAYYAB. 1966. Seasonal variation in buffaloes and cows and their effect on reproductive efficiency. West. Pak.J.Agri. Res. 4(1-2): 140-150.

MISRA, M.S., B.P. SENGUPTA AND A. ROY. 1963. Physiological reactions of buffaloes and cows maintained in two different housing conditions during summer months. Indian J.Dairy Sci.,16: 203-215.

RIFE, D.C. 1959. The Water Buffalo of India and Pakistan. Washington, D.C., International Coop. Agency, U.S.A.

SHAH, S.I., E.BASHIR AND R.BANTEL. 1994. Animal Husbandry.National Book Foundation, Islamabad.

STEEL, R.G.D. AND J.H. TORRIE. 1980. Principles and Procedures of Statistics. (A biometrical approach). McGraw Hill Kogakusha, Ltd. Tokyo, Japan.

WILLIAMSON, G. AND W.J.A.PAYNE. 1990. An Introduction to Animal Husbandry in the Tropics. 4th Edi. Longman.

SEASONAL CHANGES IN SPERM DIMENSIONS OF IRAQI BUFFALO

Adnan S. Al-Janabi [1] and Mohammed N. Taha [2]

[1] Saddam Institute for Embryo research and Infertility Tratment;

[2] Department of Biology, College of Education, Ibn Al-Haitham, University of Baghdad, Iraq

ABSTRACT

Smears were prepared from testicular and epididymal sperms taken from adult Iraqi buffalo bulls (3-5 years old) throughout 4 seasons of the year. Results showed a significant (P<0.05) decrease in the head width of testicular sperms during spring as compared to both winter and summer seasons. The tails of testicular sperms showed a significant (P<0.05) increase during spring in comparison to other seasons. The increase was reflected on total testicular sperms length which showed a similar significant increase in spring. Head shape increased significantly in summer. Epydidymal sperms, on the other hand, showed a significant (P<0.05) decrease in head during summer and a significant (P<0.05) increase in midpiece length, tail length and total sperm length during spring in sperms of caput region. Sperms of epididymal

follows page 14

corpus and cauda showed a significant (P<0.05) increase in both tails and total sperm length in spring. Head shape increased significantly during summer in caput and cauda during spring. Midpiece length of caudal sperms showed a significant (P<0.05) increase during spring. These changes in sperm dimensions may reflect seasonal modulation of testicular activity in Iraqi buffalo bulls.

INTRODUCTION

Buffaloes in Iraq are among the local domestic animals that have received little atention from scientists. Only recently, few studies have been conducted in Iraq to investigate several aspects of buffalo production and reproduction (Baghdasar and Juma, 1999; Al-Jamass, 1999; Taha, 1999). In view of the fact that no information are available on sperm dimensional changes of Iraqi buffalo bulls associated with seasons, the present study was conducted because availability of such information are essential for better understanding Iraqi buffalo reproduction under local conditions.

MATERIAL AND METHODS

The study was performed on testes and epididymis of adult buffalo bulls (3-5 years old) slaughtered at Al-Fidaylia abattoir (North-east of Baghdad). Specimens were collected from a total of 48 animals every month throughout a complete calendar year from April 1996 to March 1997. Changes in climate conditions during the period of the study were obtained from the Iraqi Meteorological Organization (Baghdad) and shown in table 1.

Testes and epididymis collected immediately after slaughtering (5-10 minutes) were kept in a cooled physiological saline solution (4 °C) before removal of surrounding tissues, and the separation of epididymis into three regions: caput, corpus and cauda.

Smears were made from the interior of both testes and epididymis after being exposed by longitudinal section. Prepared smears were stained with eosin-negrosin (Hancock, 1951). Dimensions of various sperm parts were taken using ocular and stage micrometer (2000x). Head shape was calculated (Beatty and Napier, 1960).

Results were statistically

follows page 15

Table 1. changes in climatic conditions during the study (April 1996 - March 1997) in the Baghdad area.

Season	Winter			Spring			Summer			Autumn		
Month	Dec	Jan	Feb	March	Apr	May	June	July	Aug	Sept	Oct	Nov
Max t °C	20.6	16.4	17.0	20.9	29.1	38.9	40.7	46.7	45.1	40.0	32.8	24.4
Min t °C	8.6	4.3	0.7	6.1	13.8	21.9	22.5	26.2	25.2	21.3	14.8	12.1
Avg. t °C	14.1	10.3	9.0	13.8	21.8	31.1	31.9	35.0	35.7	30.7	23.6	17.6
RH%	68	70	55	50	43	31	29	29	31	36	44	59
Light period (hrs)	5.9	5.5	8.9	8.1	9.4	10.4	13.1	12.7	12.0	10.5	9.4	6.7

Table 2. Seasonal changes in testicular sperm dimensions (μm) of Iraqi buffalo bulls.

Season	Head length	Head breadth	Sperm shape	Midpiece length	Tail length	Total length
Winter	7.34 ± 0.05 A	4.50 ± 0.00 A	1.63 ± 0.01 A	11.31 ± 0.11 A	42.49 ± 0.21 A	61.14 ± 0.23 A
Spring	7.36 ± 0.07 A	4.46 ± 0.02 B	1.65 ± 0.00 B	11.46 ± 0.14 A	43.46 ± 0.34 B	62.28 ± 0.46 B
Summer	7.39 ± 0.06 A	4.30 ± 0.06 C	1.72 ± 0.27 C	11.31 ± 0.11 A	41.87 ± 0.40 A	60.57 ± 0.37 A
Autumn	7.25 ± 0.05 A	4.35 ± 0.06 BC	1.67 ± 0.00 DB	11.52 ± 0.15 A	42.08 ± 0.29 A	60.85 ± 0.28 A

analysed using T test (Anderson *et al.*, 1986).

RESULTS

Changes in dimension of testicular sperms
No significant changes were observed in both head and midpiece length. Head breadth, however, showed a significant (P<0.05) increase in winter and spring and a significant (P<0.05) decrease in summer. Tail length and total sperm length exhibited a significant (P<0.05) increase during spring (table 2). Head shape increased significantly (P<0.05) in summer as compared to other seasons.

Changes in dimension of epidydimal sperms

Caput

A significant (P<0.05) decrease was noted in head breadth during summer associated with significant (P<0.05) increase in midpiece length in spring (table 3). Tail length and total sperm length, on the other hand, showed a significant (P<0.05) increase in spring and decrease in summer. Head shape increased significantly (P<0.05) during summer as compared with winter.

Corpus

In sperms of the *corpus*, a significant (P<0.05) decrease in head breadth was registered in summer and an increase (P<0.05) in tail length and consequently in total sperm length in spring (table 4).

Cauda

Caudas showed patterns of

follows page 16 ☞

Table 3. Seasonal changes in caput: sperm dimensions ((µm) of Iraqi buffalo bulls.

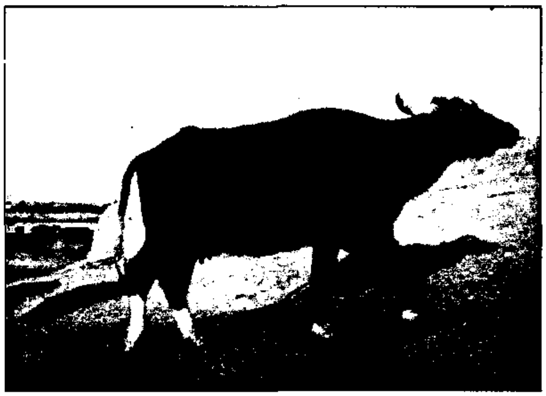
Season	Head length	Head breadth	Sperm shape	Midpiece length	Tail length	Total length
Winter	7.41 ± 0.08 A	4.61 ± 0.05 A	1.61 ± 0.02 A	11.21 ± 0.07 A	42.25 ± 0.24 A	60.87 ± 0.26 A
Spring	7.45 ± 0.07 A	4.55 ± 0.05 A	1.64 ± 0.00 AC	11.45 ± 0.17 B	43.91 ± 0.34 B	61.81 ± 0.47 B
Summer	7.38 ± 0.09 A	4.35 ± 0.07 B	1.69 ± 0.04 BC	11.22 ± 0.16 A	41.32 ± 0.21 C	59.92 ± 0.32 C
Autumn	7.31 ± 0.06 A	4.55 ± 0.07 A	1.61 ± 0.29 DB	11.30 ± 0.15 AB	42.85 ± 0.24 AC	60.46 ± 0.29 AC

Table 4. Seasonal changes in corpus: sperm dimensions ((µm) of Iraqi buffalo bulls.

Season	Head length	Head breadth	Sperm shape	Midpiece length	Tail length	Total length
Winter	7.33 ± 0.05 A	4.53 ± 0.03 A	1.62 ± 0.01 A	11.40 ± 0.13 A	42.42 ± 0.35 AB	61.14 ± 0.23 A
Spring	7.41 ± 0.07 A	4.54 ± 0.05 A	1.63 ± 0.02 A	11.52 ± 0.15 A	43.15 ± 0.57 B	62.28 ± 0.46 B
Summer	7.41 ± 0.08 A	4.35 ± 0.09 B	1.70 ± 0.28 A	11.25 ± 0.10 A	41.84 ± 0.50 A	60.57 ± 0.37 A
Autumn	7.30 ± 0.05 A	4.50 ± 0.05 A	1.62 ± 0.02 A	11.45 ± 0.16 A	41.95 ± 0.36 A	60.85 ± 0.28 A

Table 5. Seasonal changes in cauda: sperm dimensions ((µm) of Iraqi buffalo bulls.

Season	Head length	Head breadth	Sperm shape	Midpiece length	Tail length	Total length
Winter	7.30 ± 0.05 A	4.53 ± 0.00 A	1.61 ± 0.02 A	11.25 ± 0.07 AC	42.45 ± 0.24 A	61.00 ± 0.30 A
Spring	7.41 ± 0.07 A	4.49 ± 0.02 A	1.65 ± 0.02 AB	11.60 ± 0.15 B	43.30 ± 0.39 B	62.31 ± 0.55 B
Summer	7.39 ± 0.09 A	4.37 ± 0.06 B	1.69 ± 0.02 BD	11.22 ± 0.13 C	41.82 ± 0.41 AC	60.43 ± 0.50 A
Autumn	7.50 ± 0.09 A	4.51 ± 0.06 AB	1.67 ± 0.01 CD	11.37 ± 0.11 AB	41.68 ± 0.25 C	60.55 ± 0.33 A



Iraqi buffaloes at Mosul on Tigris river.

change in dimension similar to those seen in the *corpus*, in addition to a significant (P<0.05) increase in midpiece length in spring. Sperm shape increased significantly (P<0.05) during summer and autumn as compared to winter (table 5).

DISCUSSION

The data presented in this paper are similar to those reported by Mohmoud (1952) on Egyptian buffalo. They are also close to values of sperm measurement in Murrah bulls in India (Kumar et al., 1997). Iraqi buffalo bulls have been referred to show a decrease in various sperm characteristics with degenerative changes during summer and autumn, while winter and spring produce a significant improvement of these aspects (Taha, 1999). Such a seasonal pattern in the reproductive activity agrees with the results reported in other countries in both cattle and buffalo (Basu, 1962; Goswami and Nair, 1964). Several authors tried to correlate sperm dimensions with fertility (Kumar et al., 1997). Positive correlations between conception rate and sperm head length and shape were reported. On the contrary, Koley *et al.* (1985) suggested that the decreased fertility of sperms is associated with broader sperm head, and increase in fertility with longer head. Our results seem to disagree with this finding, because head shape increased markedly during summer and autumn, i.e. the seasons of decreased reproductive activity. Moreover, heads width increased significantly during winter and spring, i.e. the seasons of increased reproductive activity. Furthermore, the present study indicated that tail length seems to increase significantly during the favourable season for reproductive activity (winter and spring) and this increase is reflected on total sperm length. Midpiece length of epidydimal spermatozoa increased markedly during spring. It is well known that midpiece region contributes to providing metabolic energy necessary for the sperm activity, including tail movements (Ganong, 1955). We suggest therefore that the increase in the dimensions of this region contributes to increase fertility through improving sperm motility.

REFERENCES

AL-JAMASS R.K.A. (1999). Determination of some featural and production traits on Iraqi buffaloes in Badosh. Buffalo newsletter, no.12:12-13.

ANDERSON D.R. , SWEENEY D.J AND WILLIAMS T.A. (1986). Statistics Concepts and Applications. West Publishing Company, St. paul, new York, pp. 687.

BAGHDASAR G.A. AND JUMA K.H. (1999). Some non-genetic influences on total milk yield in Iraqi buffaloes. Buffalo newsletter no. 12:10-11.

BASU S. (1962). The influence of milk yield on the occurrence of post-partum estrus in Murrah buffaloes. Indian Vet.J., 39:328-332.

BEATTY R.A. AND NAPIER R.A.N. (1960). Genetics of gamete 2-strain differences in characteristics of rabbit spermatozoa. Proc. Roy. Soc., Edinburgh, 3_17-24.

GANONG W.F. (1995). Review of medical Physiology.17th (Ed. Lange medical Publications, Los Altos, California, pp. 781.

GOSWAMI S.P. AND NAIR A.P. (1964). Effect of some climatological factors on reproduction of buffaloes. Indian J. Vet. Sci., 34:127-134.

HANCOCK J.L. (1951). A staining technique for the study of temperature shock in semen. Nature, 167:323-325.

KOLEY N, MUKHERJEE D.P. AND CHOUDHURY G. (1985). The effect of season on sperm dimensions of pure and crossbred bulls. Indian Vet. J., 62:698-704.

KUMAR R., BHAT P.N. AND SAXENA M.C. (1977). A note of biometrics of buffalo bull spermatozoa in relation to fertility. Indian J. Anim. Sci., 47(2):93-94.

MOHMOUD I.N. (1952). Some characteristics of the semen of Egyptian buffaloes. Cairo, faculty of Agriculture, Fouad I University, Bulletin no. 15.

TAHA M.N. (1999). Seasonal changes in some organs of the reproductive system of Iraqi buffalo bulls. PhD thesis. College of Education (Ibn Al-haitham). University of Baghdad.

FEASIBILITY OF INTRODUCING BUFFALOES INTO SOME AFRICAN COUNTRIES

Antonio Borghese and Bianca Moioli

Istituto Sperimentale per la Zootecnia, via Salaria 31, 00016 Monterotondo Rome, Italy

Email: isz@flashnet.it

ABSTRACT

This paper discusses the opportunities of developing river buffalo production in Africa. Only in Egypt, in fact, Bubalus bubalis is reared as milk and meat producer.
Problems relating to climatic adaptation, feeding and nutrition, pathologies and management are discussed. The potential African areas where buffalo production is likely to be succesful are identified on the basis of the following parameters: percentage of dairy cows out of total cattle; average annual milk production; increase or decrease in cattle number in the past 10 years. North and East African countries look more vocated to eventual buffalo introduction because of their tradition in dairy production and consumption. However, a blind import of buffalo to countries with no buffalo tradition is a nonsense if all aspect relevant to general physiology, reproduction, health, feeding, management, performance recording and marketing are not carefully taken into account. It is suggested that a local organization cooperates in planning and super-vising all necessary actions for a successful buffalo production system.

Key words: *buffalo, African countries, livestock production.*

INTRODUCTION

This paper will discuss the opportunities of developing river buffalo production in Africa. Therefore, the indigenous wild African buffalo (Syncerus caffer) will not be here considered. However, a short mention of this indigenous African species, which is very little known to most animal production scientists, is here necessary. The African buffalo is referred to be a large, suspicious and ferocious animal (Mason, 1974) and has never been domesticated. In the classification of the "Bovini" tribe, three groups are distinguished: Cattle, Asian buffalo and African buffalo. African buffalo therefore belongs not only to a different species as respect to Asian buffalo, but also to a different group and a different genus (genus Syncerus) respect to genus Bubalus of Asia and Europe. Chromosome number is 52 in Syncerus; 50 in Bubalus bubalis River group and 48 in Bubalus bubalis Swamp group: therefore interbreeding between Syncerus caffer and Bubalus bubalis appears impossible.
Very few studies exist on African buffalo, which is found in the forest and savannah regions of Africa, south of the Sahara: Ethiopia, Sudan, Zaire, Congo, Chad, South Africa. The number was referrend to be 2-3 million (Mammerick, 1961). In view of its tolerance to tsetse fly and trypanosomiasis as well as to sustainability to the environment, the possibility of producing fertile hybrids with the Asian river buffalo appeared attractive to the extent that experiments of crossbreeding with Indian buffalo were done. Unfortunately, such experiments were unsuccesful (Bigalke and Neitz, 1954).
Further trials to introduce in Africa the river buffalo for purebreeding were performed in Madagascar (1957), Mozambique (1962), South Africa (1904), Tanzania (1923), Tunisia (1958), Uganda (1971), Zaire and Congo (1914). Such trials were all unsuccessful (W. Ross Cockrill, 1974) and there are no buffalo herd now except for one only herd in Mozambique. It appears that lack of appropriate management skills made all these trials to fail.
Some animals were imported also in Madagascar, Uganda, Zaire and Congo (Alexiev, 1998).
The river buffalo is bred with good results in terms of milk and milk products, meat and work in Egypt only, along Nilus river valley and Fayum oasis. In fact the expansion of buffalo from the Indo valley towards both East and West occured in the first centuries a.D. and was developed in the civilizations of the rivers: to Mekong and Yellow River (Far East), to Tigris and Eufrates (Near East), to Nilus (Africa) and Sele and Volturno (Italy).
For this reason, the diffusion of buffalo in Africa depends on the availability of water, to the extent that Bubalus bubalis is commonly called "water buffalo".

CLIMATIC ADAPTATION

Buffaloes are more sensitive than cattle to direct solar radiation and ambient temperature. However, buffalo has a peculiar ability to seek water as a means to reduce the heat load. In case there is no access to water Sastry (1983) refers that shade serves equally well because evaporation along the respiratory tract is an important mechanism of heat loss in buffalo.
buffaloes are a less efficient water users, as evidenced by their higher intake of water per unit dry matter intake, higher urine outputs and lower percentage kidney reabsorption of filtered water (Moran et al., 1979). Suitable protection against thermal stress is thus an essential requirement for buffalo husbandry. Karam Shah (1979) has demonstrated that shade is the most important protective

follows page 18 ☞

measure and that loose housing, in the form of simple shelters with grass thatch or bamboo are the most suitable and less expensive structures.
In hot climates, water availability increases in importance. The provision of wallows is not considered optimal, unless there is a continuos change of water, because of the dirt that accumulates in the wallow; on the contrary, splashing water during the hottest parts of the day and the provision of cooled drinking water alleviate the thermal stress. These practices are regularly followed in most villages in India.
Buffalo calves under one year of age are more sensitive to heat stress. However, high mortality of buffalo calves is a universal problem. Well ventilated housing is therefore essential for them and particular care should be taken during the short critical period after birth to assure that the calf consumes enough colostrum.
Heat stress produces also a lowered feed consumption and utilization; however it was demostrated (Singh, 1983) that the same animals, at night, under field conditions, have a higher dry matter intake. Therefore is important to make deeper researches on the effect of temperature on nutrition intake and on milk production (Chauhan et al., 1998) on nutrient utilization and on biochemical and physiological parameters in growing calves (Chauhan et al., 1999), during transport (Kanchev et al., 1997), and the possibility to reduce the hot stress with the availability of wallows (Terzano et al., 2000) or showers.

FEEDING AND NUTRITION

Average daily milk yield registers a huge variability in river buffalo, depending on the breed, the country and especially the management and feeding system. It can range from 3-4 kg milk/day for poorly fed animals (grazing and byproducts) to even 15 kg/day in intensive management systems.
In the countries of Europe and the Near-East, except Italy, extensive management systems are employed, allowing to obtain a yearly milk production in about 270 days lactation of 900-1000 kg milk. Such extensive systems include grazing in the favourable seasons. In all cases, green forage "cut-and-carry" – composed of leguminous varying from country to country – concentrates and byproducts are the basic foodstuff. Green forage and hay are made mainly of alfalfa in Italy, Bulgaria, Romania and Turkey and *Trifoliulm alexandrinum* in Egypt. Most common byproducts given to buffaloes are brewer grain residuals in Italy and Bulgaria, sugarbeet-pulp in Italy, Bulgaria and Iran, cotton residuals in Egypt and Azerbaijan, tomato peel in Italy, apple juice residuals in Iran, sugarcane residuals in Egypt and Iran, stalk and cobs in Iran, Egypt and Romania and straw everywhere.
In India and Pakistan most common type of feeding for buffaloes yielding 10 kg milk/day is composed of green forages (*Trifoliulm alexandrinum, alfalfa*, green oats) with the addition of a concentrate mixture and straw (Ranjhan and Pathak, 1983, table 1).
In Iraqi marshes, buffaloes swim half-submerged on the aquatic vegetation all day long, where they get the major bulk of feed. During the night, when they return to the floating islands where they live, they are fed the green forage cut by the farmer during the day; this forage is composed of reeds, papyrus, various water plants, and rice hulls when available.
In Italy, dairy buffaloes are managed in the same intensive way as dairy cows, maintained in loose housing paddocks all over the year. Maize silage and grass silage are the main feeding source. Average yearly milk production registered for buffaloes in Italy is 2000 kg although five percent of the recorded buffalo overtake 3000 kg.
An example of feeding schedule for high yielding buffaloes is reported in table 2.
But similar very energetic diets (0,80-0,85 UFL/kg s.s.) are used in Italy only in particular selected genotypes where highest milk productions are requested for the very convenient price of milk (3 times cow milk) and

follows page 19 ☞

Table 1. Feeding schedule for lactating buffaloes yielding 10 liters/day. (Ranjhan and Pathak,1983)

Feed		Quantity (kg)
Ration 1		
	Green berseem (15% D.M., 1.5% D.C.P., 10% T.D.N., 0.360 Mcal M.E. on fresh basis)	85
Ration 2		
	Green berseen/alfalfa/cowpea	60
	Wheat straw	5.5
Ration 3		
	Green oats (25% D.M., 1.6% D.C.P., 16.7% T.D.N., 0.61 Mcal M.E. on fresh basis)	20
	Concentrate mixture (15% D.C.P., 73% T.D.N., 26 Mcal M.E.)	4
	Wheat straw (0% D.C.P., 40% T.D.N., 1.4% Mcal M.E.)	5
Ration 4		
	Chaffed wheat straw (0% D.C.P., 40% T.D.N., Mcal M.E.)	8
	Concentrate mixture	7

because the employment of concentrates increases milk protein (4.5-5.0%) and fat (8-9%) content (Bertoni et al., 1991; Tripaldi 1993, Verna et al., 1994) These characteristics are necessary for the quality of mozzarella cheese, the luxurious, expensive cheese produced from buffalo milk in Italy. The demand of high quality mozzarella in Italy and in the world has stimulated the development of selection, husbandry, reproduction and nutrition techniques and the increasing of buffalo farming in Italy.
In African Countries it is possible to exploit buffaloes better than other ruminants for the higher ruminal microbial number vs bovines (Puppo et al., 1998) and their better nitrogen digestibility and degradability with very fibrous diets (Puppo e Grandoni, 1994; Puppo et al, 1998). In fact buffaloes showed better digestion capacity than other ruminants with higher forages/concentrates ratio and low energetic concentration diets (Settineri et al., 1993; 1995; Bartocci and Di Lella, 1994) that are common in extensive conditions of Africa. Therefore the possibility of buffalo adaption to African environments includes also the ability to utilize effectively the poor resources.

Table 2- Example of daily feeding schedule for a 10 kg milk producing buffalo in Italy

Component	kg	kg dry matter	UFL	Crude protein (g)	Fibre (g)
Alfalfa hay	7.5	6.45	3.87	650	2220
Maize silage	16.0	5.12	4.56	385	950
Concentrate (3.8% protein)	3.0	2.64	2.90	1000	320
Maize grains	1.3	1.14	1.45	115	25
Total	27.8	15.35	12.78	2150	3515

PATHOLOGY

Buffalo pathologies are similar to those described in cattle even if few deseases are peculiar of buffalo that show more resistance to other diseases than cattle, for higher adaptation capacity to hot-humid climates.

1 - Parassites infections
It is very easy, particularly in developing countries, (Borghese et al., 1997) to find parassites infections as gastrointestinal helminths (Strongiloides, Toxocara, Moniezia, Mammonogamus) and coccidia (Eimeria, Giardia, Cryptosporidium), liver parassites (Fasciola) , tick parassites (Hyalomma, Sarcoptes) blood parassites (Theileria), that produce the most important economic losses in buffalo breeding.
2 - Bacterial infections
Escherichia coli is a Gram negative bacillus, that can cause gastroenteric pathologies, particularly in calves, associated with other bacteria (Enterobacter, Pseudomonas, Klebsiella) or coccidia or verminosis or virosis. The respiratory diseases are caused by Pasteurella, Staphylococcus, Streptococcus, Escherichia coli, that can cause high mortality, if the animals are non treated by antibiotics.
Pasteurella multicida is responsible of Haemorragic septicaemia, the most serious desease in buffalo because of high mortality particularly in tropical Asian countries, but it could be controlled by antibiotics and vaccines.
Tuberculosis, produced by Mycobacterium, is a serious zoonosis, that could be eradicated after tubercolin diagnosis.
Brucellosis, by Brucella, is another zoonosis, that need to be eradicated after serological diagnosis, because it could cause serious disease in populations, reproductive disorders and infertility in buffalo. Vaccination can be applied only in developing countries.
Leptospirosis is another zoonosis, produced by Leptospira linked to water sources contaminated by rodents.
Listeriosis, by Listeria, produces meningoencephalitis, abortion and septicaemia: the listeria could be found in silages.
Chlamidia, Ricketsia, Paratuberculosis are present in developed countries also, as mastitis incidence is linked to dairy buffaloes.
3 - Viral infections
Prophylaxis is very important to control some viral infections that could cause neonatal diarrhoea (Rotavirus Coronavirus) particularly in intensive systems. IBR (bovine Rhinotracheitis) BVD (bovine diarrhoea) BHV (bovine Herpesvirus) have been diffused by cattle in buffalo intensive farms.
In developing countries is present the foot and mouth disease by Aphthovirus.
4 - Other pathologies
Buffaloes could be affected by Mycotic infections, tumors, reproduction disorders and uterus prolaxe.

BUFFALO SUSTAINABILITY IN THE WORLD

Buffalo has proved to be, in several countries, an important source of work, animal proteins from milk and meat, and for the smallholders it gives additional farm income with the manure, a worldwide recognized cheap and good fertilizer. In Nepal, Thailand, China and India many smallholders depend on buffalo for fertilizing their crops (Keshary, 1978, Pilla, 1995). But buffalo sustainability all over the world can be increased (Borghese and Moioli, 1999)

follows page 20 ☞

through the implementation of appropriate key actions which exploit the results obtained during the ongoing development projects as well as by research institutions. In particular the research has contributed to achieve a high production level in the breeding stock, thanks to the application of milk recording systems, progeny testint and targeted breeding strategies. If these systems will be applied at regional or national level, coordinated by appropriate organizations, successful genetic improvement will be achieved.
Research in dairy technology has been widely carried out in Italy and has demonstrated that buffalo milk is suitable to processing into various dairy products which might be exported all over the world through an appropriate marketing organization. The same could apply to meat production, which should take into account the results obtained by Italian and Bulgarian researchers in the identification of the best fattening systems as well as of alternative meat products, like cured meats, "salami" and sausages, which better satisfy the consumer's taste and that could be exported as delicatessen, if properly promoted.
The belief that buffalo has a poor reproductive efficiency was demonstrated to be wrong by several research institutions, in particular italian (Borghese et al., 1996). In fact with appropriate rearing systems for female calves and heifers, puberty can be anticipated and age at first calving decreased by several months. The use of artificial insemination can be increased through estrus synchronization obtained with intravaginal implant of silicon coils (PRID + PMSG+PGF2α) for 10 days followed by an injection of 1000 UI PMSG and 15 mg Luprostiol on the 7th day. The insemination offered after synchronization turned out into a very satisfying pregnancy rate.
By intensifying international cooperation and exchange of expertise among research institutions, governments and development organizations, buffalo will have many chances to survice and expand in the framework of a sustainable agriculture.

INTRODUCTION OF BUFFALOES IN THE AFRICAN COUNTRIES

In order to promote the introduction of river buffalo in African countries, several economic aspects, on top of the mentioned biological ones, must be taken into account. Although the above mentioned trials were unsuccessful, it is believed that they fail because of lack of adequate knowledge of buffalo physiology and non-appropriate management.
Two main issues are in favour of the introduction of dairy buffaloes in Africa:
The first is the poor milk productivity of dairy cows in Africa: 450 kg milk yearly, while the world average is 2061 kg. Such low productivity is due not only to poor feeding and management resources, but mainly to the employed indigenous breeds. African countries, generally, have not experienced the progressive move registered all over the world towards high yielding breeds of Holstein-Brown type, because such high selected breeds cannot fit in the local environments and easily go under health and reproductive problems which reduce their productivity.
The second, is the sustainability of buffalo production. In fact, the intensive management systems requested by the high productive cattle breeds have a damaging impact on the environment and disagree with the promotion of a sustainable agriculture. Buffalo, on the contrary, is reared in a large variety of sustainable production systems in the developing countries, producing milk of higher nutrition quality: buffalo milk is much richer in total solids than cow milk (protein content is twice higher, and fat content three times higher), therefore it is especially suitable for butterfat production and cheese production (Borghese et al., 2000); moreover, the skimmed milk obtained after the removal of the cream, is a precious protein source for human consumption.
In order to evaluate which countries could be more suitable for introducing buffaloes, the following methodology has been used. We assumed that the potential areas are the same where dairy cattle production has the major importance, for two reasons: first for the similarities between dairy cattle and dairy buffalo production and the need of existing traditions for the practices of milking and milk processing; second, because the presence of dairy cattle indicates the human attitude to use milk and dairy products, therefore a potential market demand for buffalo milk can be hypotized. We emphasize the second point because we should be aware that in most East-Asian countries, like Thailand, the Philippines and Vietnam, human population in general is not used to consume milk, and despite of the large presence in those areas of swamp buffalo, animals are rarely milked and have been improved only to a very little extent through crossbreeding with river buffalo.
The considered data were the number of total cattle, number of dairy cows and average milk production in each African country (FAO Yearbook Production, 1995). Only African countries having at least a total cattle population of 200,000 heads were here considered.
The following parameters were identified to define the potential African areas:
1) Percentage of dairy cows out of total cattle heads;
2) Average annual milk production;
3) Increase or decrease in cattle

follows page 21 ☞

number in the past 10 years.
In table 3 total cattle number, total dairy cows, percentage of dairy cows out of total cattle heads and yearly milk production are reported.
As regards to the proportion of dairy cows, as expected, the countries showing the highest proportion (from 40 to 60%) are the North-African (Morocco, Tunisia, Egypt and Algeria). This confirms the renown that milk is a fundamental food in the Mediterranean, confirmed also by the utilization of milk from all species (sheep, goat, camel) in this countries and in particular in Morocco. North-Africa is followed by East-African countries (Somalia, Kenya, Mozambique, Tanzania) plus a few more countries bordering the previous mentioned (Mauritania, Niger, Sudan, Uganda and Zimbabwe); these countries have a proportion of 20% dairy cows out of total cattle. In the remaining countries the percentage is lower than 20%.
As regards to the average yearly milk production, an immense variability is evident. Only in three countries (South Africa, Tunisia and Algeria) milk productivity reaches 1,000 kg. In a second group (Egypt, Morocco, Camerun, Kenya, Angola, Sudan, Somalia, Niger and Zimbabwe) milk productivity ranges from 400 to 670 kg milk (the average for all Africa). The remaining countries lie below 360 kg/year. It must be noted that some of these poor milk producing countries have not only a high number of cattle but also a high proportion of dairy cattle out of total cattle, like Mauritania, Uganda, Tanzania and Mozambique.
As regards to the trend in cattle population, no big changes in numbers were registered in the past decade, with a few exception, such as a consistent decrease in both total cattle and dairy cows in Morocco and Zimbabwe, a consistent increase of the same in Sudan and Nigeria; a moderate increase of dairy cows in Mauritania,

Table 3- Total cattle, dairy cows, increasing trend and average milk productivity in Africa. Source FAO, 1995

Country	Total cattle 1000/heads	Trend total cattle (*)	Dairy cows 1000/heads	Trend dairy cows (*)	% dairy cows/ total cattle	Average year milk production (kg)
Algeria	1300	s	560	d	43	946
Angola	3280	s	328	i	10	488
Benin	1223	i	125	s	10	130
Botswana	2800	i	335	s	12	350
Burkina F.	4350	i	690	s	16	175
Cameron	4900	s	250	s	5	500
Rep.Centr.Africa	2797	s	218	s	8	483
Chad	4539	i	455	s	10	270
Egypt	3100	i	1475	s	47	679
Ethiopia	29825	s	3534	s	12	209
Guinea	1780	i	250	s	14	185
Kenya	13000	s	4420	s	34	489
Madagascar	10309	s	1753	s	17	276
Mali	5542	s	555	s	10	245
Mauritania	1125	d	303	i	27	350
Marocco	2490	d	1500	d	60	553
Mozambique	1280	d	346	s	27	170
Niger	2008	i	410	i	20	400
Nigeria	17791	i	1630	i	9	233
Senegal	2850	i	287	s	10	360
Somalia	5200	d	1360	s	26	412
South Africa	13015	i	930	s	7	2663
Sudan	22000	i	5400	i	24	480
Tanzania	13376	s	3250	s	24	182
Tunisia	735	i	390	i	53	1823
Uganda	5200	s	1300	i	25	350
Zambia	3300	i	297	s	9	300
Zimbabwe	4500	d	990	d	22	424

(*) i= increasing; d= decreasing; s= steady.

Angola, Tunisia, Niger and Uganda.
Considering the previous assumptions, the countries with the best potential for introducing buffalo could be the following:
1. For their dairy tradition (parameter 1): Morocco, Tunisia, Algeria, Kenya, Sudan, Somalia, Mauritania, Mozambique, Uganda;
2. Because they have registered a trend to increase (parameter 3) cattle and/or dairy cow number: Sudan, Mauritania, Angola, Tunisia.
3. Because their milk productivity could be highly increased (parameter 2): Tanzania (actually 182 kg/year), Mozambique (170 kg/year), Uganda (350 kg/year), Niger (400 kg/year);

SEVERAL STEPS FOR INTRODUCTION OF BUFFALO IN AFRICAN TARGETED COUNTRIES.

1. Economy is the most important aspect, as regards to the expected market demand of buffalo milk. Surveys must be performed to verify how buffalo milk will be marketed and who will be marketing milk. It is renown that buffalo milk can be processed in a huge number (Borghese et al., 2000) of dairy products, both fat-based products (cream, butter) and protein products (cheese, curd, yoghurt) and that in India mainly it is used for liquid consumption after dilution. It must be noted that in every country buffalo milk has

follows page 22 ☞

its own specific outlet, depending on the tradition and the request of human population. It is rare to find that in the same area buffalo milk is used for different purposes: in Italy nothing else but "mozzarella cheese" is produced, in Bulgaria yoghurt, in Iraq mostly cream, in Azerbaijan butter, in Iran cheese, in most Asian countries home-made fatty products. It is important also to define how the production will be marketed. In Asia, most buffalo milk is home-processed; in Italy it is rarely processed at the farm, but it is sold to dairies; in other Eastern-European countries it is mostly home-processed, while in Iraq it is all sold to dairy plants. Therefore, before introducing buffalo, it is important to know where and how milk will be marketed, that means to create a marketing structure where it does not exist yet.

2. All aspects relevant to buffalo phisiology and health mentioned in this paper must be taken into account: water availability and shelters to cope with thermal stress are a must.

3. A feeding programme based on the available feeding resources must be drafted. The feeding programme should carefully evaluate the cost/benefit ratio, but should aim to have animals producing at least 4-5 kg milk daily. Marketing opportunities for small amounts of milk are null.

4. It is suggested that a local organization supervises the introductory trial. It is well known how clever livestock exporters can take advantage of the lack of knowledge of local farmers by promising high profits. Such local organizations might be composed of technicians and animal production experts from the Governments or also Research Institutions that might help in planning and supervising all necessary actions for a succesful livestock system: housing, management, feeding reproduction, health control, animal registration and milk recording.

Paper presented at 3rd All Africa and 11th Egyptian Society of Animal Production Conference, Egypt, November 2000

LITERATURE

ALEXIEV A., 1998. The water buffalo. St. Kliment Ohridski University Press Sofia.

BARTOCCI S., DI LELLA T. (1994). Capacità di utilizzazione digestiva degli alimenti, Agric. e Ricerca 153:49-56.

BERTONI G., PICCIOLI CAPPELLI F., BERNABUCCI V., DI STEFANO E. (1991). Some effects of feeding management on milk production and metabolism of dairy buffaloes. In Proceedings 3rd World Buffalo Congress (Varna, Bulgaria 13-18 maggio).

BIGALKE R.C. AND NEITZ W.O. (1954). Indigenous ungulates as a possible source of new domesticated animal. J.S. Afr. vet. med. Ass., 25:4, 45-54.

BORGHESE A., TERZANO G., BARILE V.L., SEREN E., PARMEGGIANI A., SOFLAI S.M., ZICARELLI L., BONI R., DI PALO R. (1996). News in Buffalo reproduction. Bulgarian Journal of Agricultural Science, 2: 35-46.

BORGHESE A., FAILLA S., BARILE V.L. Edr. 5th World Buffalo Congress (Caserta) October 13-16.

BORGHESE A., MOIOLI B. (1999). Buffalo population and products in Europe and the Near Eastern countries. International Conference on sustainable animal production, health amd environment: future challenges. November 24-27 Hisar, India.

BORGHESE A., MOIOLI B., TRIPALDI C. (2000). Buffalo Milk: processing and product development in Mediterranean countries. 3rd Asian Buffalo Congress, Kandy Sri Lanka 27-31 marzo.

CHAUHAN T. R., DAHIYA S.S., GUPTA R., HOODA O.K., LALL D., PUNIA B.S. (1998). Effect of climatic stress on nutrient intake, their utilization and milk production in buffaloes in late lactation. Buffalo J. 14(3):321-327.

CHAUHAN T. R., DAHIYA S.S., GUPTA R., HOODA O.K., BHARDWAJ H., PUNIA B.S. (1999). Effect of extreme cold on voluntary dry matter intake, nutrient utilization, some bio-chemical and physiological parameters in growing buffalo calves. Buffalo J. 15(2):133-141.

KANCHEV L.N., DANEV A., ALEXANDROV K., DEIANOVA P. (1997). Influence of melatonin on cortisol concentration during transport stress in buffalo. Proc. 5th World Buffalo Congress, Caserta 13-16 Ottobre, 933-936.

FAO YEARBOOK PRODUCTION , 49, 1995.

KESHARY K.R., (1978). Livestock production in Nepal. In: M.G. Cooper (Editor), Livestock Development Programs for Asiaìs Small Farmer. Proc.Seminar held at the 55 th Annual Conference of the Australian Veterinary Association, 15 May 1978, Sidney: 28-30.

KARAM SHAH ET ALL., (1979). Effect of cooling during summer months on milk production of Nili-Ravi buffaloes. J. Anim. Sciences, Pakistan, 1: 35-40.

MAMMERICK M. (1961). Les buffles domestiques dìAsie importÈs au Congo. Bruxelles, Institut National pour lÈtude agronomique du Congo. Publication, SÈrie technique No.64.

Mason I. L. (1974). Species, types and breeds. In ìThe husbandry and health of the domestic buffaloî FAO, Rome

MORAN ET AL., (1979). The intake, digestibility and utilization of a low quality roughage by Brahman cross, buffalo, Bauteng and Shorthorn steers. Aust. J. Agric. Res., 30: 333-340.

PILLA A. (1995). Buffalo in China. Buffalo News Letter, 3:4-5.

PUPPO S., GRANDONI F. (1994). Comparison between buffaloes and cattle fed on fibrous diets: variation in ruminal microflora and VFA during the day. D. Giesecke (editor). In Proceedings of the Society of Nutrition Physiology (Frankfurt, Germany), DLG-Verlag. 3: 210.

PUPPO S., AMICI A., GRANDONI F., BARTOCCI S., (1998). Rumen microbiol counts and in vivo digestibility in buffaloes and cattle fed different diets. In printing.

Ranjhan S.K. and Pathak N.N. (1983). Management and Feeding of Buffaloes, 2nd edn, Vikas Publishing, Schibabad, Ghasiabad, India.

ROSS COCKRILL W. (1974), The water buffalo in Africa. In ìThe husbandry and health of the domestic buffaloî FAO, Rome.

SASTRY N.S.R. (1983). Buffalo husbandry: contraints to successful buffalo farming and overcoming the same through management. Hohenheim, Stuttgart.

SETTINERI D., PACE V., ANNICCHIARICO G., MARZOLI C. (1993). Fibrous fractions degradation of some animal feeds in rumen of buffalo and cattle. In Proceedings of Int. Symp: "Prospect of buffalo production in the Mediterranean and Middle East" (Cairo 9-12 novembre1992), EAAP Pubblications, 62, Pudoc Sci. Ed.:290.293.

SETTINERI D., PACE V., ANNICCHIARICO G., MARZOLI C. (1995). Rumen organic matter degradability of feedstuffs and by productions with different fibre concentrations in buffaloes and cattle. Buffalo J., 1:15-37.

SINGH M.P. (1983). Studies on the effects of three systems of housing for growing buffaloes on feed consumption and utilization and water intake during summer and winter. Ph. D. thesis. Haryana Agric. Univ., Hisar. India.

TERZANO G., TRIPALDI C., ALLEGRINI S., PASQUI E., RONCORONI C., SCATÀ M.C., TERRAMOCCIA S. (2000). Benessere e riproduzione: approccio sperimentale sulla specie bufalina.Worshop "Stato di benessere ed efficienza riproduttiva negli animali d interesse zootecnico" Viterbo 3-4 maggio.

TRIPALDI C., (1993). Effetto di alcune diete sulle caratteristiche qualitative del latte di bufala. Agric. e ricerca, 16(153): 79-83.

VERNA M., BARTOCCI S., AMICI A., AGOSTINI M. (1994). Effetto di diete diverse sulle prestazioni produttive di bufale in lattazione. Agric. e ricerca, 16 (153): 73-78.

FAO TECHNICAL CO-OPERATION PROJECTS

The Buffalo Workshop on "Animal Recording for Improved Breeding and Management Strategies of Buffalo", held in Bled, Slovenia (16-17 May 2000) was an important milestone in the international cooperation in buffalo performance recording. Participants from several developing countries emphasized the need for standardized milk recording systems in order to promote the improvement of productivity and to allow animal production comparison across countries. They made evident also the need for new recording methodologies and techniques for lower input animal production systems.

FAO promoted and supported the Workshop in all aspects: financial, technical, and scientific. The constraints to implementing sustainable recording schemes at country level were approached and discussed. Proposals and solutions were also suggested and **Guidelines For Simplified Buffalo Milk Recording for Low to Medium Input Production Systems** were drafted and are included in the Proceedings of the Workshop published in ICAR Technical Series No. 4, December 2000.

The followr-up of the Workshop now depends on every single country to take concrete steps to deepen the proposed international cooperation, and make decisions to implement a sustainable animal recording system.

On official request made by the member governments, the Food and Agriculture Organization of the United Nations could provide technical support to countries that intend to pursue planning and establishment of a new vital unit, such as animal recording service, to enhance livestock performance and productivity in a country. Such specific support FAO can provide through **Technical Cooperation Programme (TCP),** which is meant to provide catalytic initial input to help a country:

- To meet urgent and immediate needs which affect the country's food and agricultural situation
- To stimulate increased investments in agriculture with the support of external or local funding
- To provide training of key people directly involved in a new venture in agriculture
- To assist in planning advisory services in specialized fields
- To initiate pilot activities and provide small amounts of supplies urgently required to stimulate production

The requests for FAO Technical Cooperation Programme support have to be drafted by competent country institutions, they have to be acknowledged as high priority in the country's development plans and presented to FAO by the competent Ministry through the FAO Country representative. Guidelines for the preparation and formulation of TCP projects can be requested from the local competent Ministry or the FAO Country Office.

ICAR and the coordination centre of the Buffalo Network are available to assist any country in the drafting of projects on animal recording.

Juhani Maki-Hokkonen
Animal Production and Health Division
FAO, Rome

buffalo news - buffalo news - buffalo news - buffalo news - buffalo news - buffalo news

32ND SESSION OF THE INTERNATIONAL COMMITTEE FOR ANIMAL RECORDING (ICAR) AND ASSOCIATED BUFFALO WORKSHOP

The 32nd ICAR Session, held in Bled, Slovenia, 14-19 May 2000, was an important milestone in the international cooperation in animal performance recording: 450 participants from 59 countries. A strong orientation towards quality and new fields of recording was emphasized in the topics of discussion; a clear signal came from developing countries on the need for new recording methodologies and techniques for lower input animal production systems; two specific workshops were organized on Buffalo and on Animal Recording in Central-Eastern Europe. The efficiency and warm hospitality of the Slovenian organizers was excellent and the alpine town in which the event took place was simply marvellous.

It is important to give here a brief report on the "Buffalo Workshop", held at Bled during the ICAR session.

The joint FAO-ICAR Buffalo Workshop on "Animal Recording for Improved Breeding and Management Strategies of Buffalo" (16 - 17 May 2000) had the following objectives:

- Promote buffalo recording in the developing countries and to make possible comparison of animal productivity across countries;
- Enforce international

follows page 24 ☞

Milk recording using a scale (private buffalo farm, Okara, Pakistan). The recorder weighs the milk.

collaboration (network) for the development of buffalo production;

- Increase awareness of the value of appropriate recording systems for the management of buffalo genetic resources;
- Promote the use of records to assess the merit of animals, to improve farm management systems and to increase profitability of farming.

The main outputs of the workshop are the Proceedings and recommendations for international standardised guidelines of buffalo performance recording

The workshop was attended by 30 participants from 17 countries. Eleven of these countries (Azerbaijan, Albania, Armenia, Bangladesh, Iran, Iraq, Nepal, Pakistan, Sudan, Thailand and Vietnam) had never attended any ICAR meeting in the past. The participants from Bulgaria, Egypt, Greece, India, Italy, and Turkey, that are already ICAR member countries, were in this case specalists in buffalo development.

FAO supported financially all participation expenses of the people from developing countries as well as the publicaton of the Proceedings. Furthermore, Senior staff of FAO, mainly Dr. Juhani Maki-Hokkonen and Dr. Salah Galal, provided helpful suggestions and expertise without which the Workshop could not have been as successful as it was. All participants want to express their thanks to FAO Animal Production and Health Division as well as the FAO Regional Offices for Europe, Near East, and Asia and the Pacific.

The workshop was run in four sessions:

1 - Presentation of the 7 existing country cases of buffalo milk recording systems

2 - Discussion on "Justification and components of a functional milk recording scheme"

3 - Discussion on "Initiation and implementation of a sustainable recording scheme"

4 - Discussion on "Necessary components for a buffalo improvement programme".

The conclusions from the Workshop were the following:

Seven ongoing cases of on-field milk recording for buffalo are effective, the major features of which are the following:

1 - Purpose of milk recording involves both improved farm management and selection decisions in 4 cases (Bulgaria, Italy, Egypt and Iran). Selection of breeding animals at national or regional level is the only purpose of milk recording in 3 cases (India, Pakistan and Nepal).

2 - Milk recording and selection activity is performed and controlled directly by the government through its own established structures and staff in 3 cases (Pakistan, Iran, Nepal); it is performed through the cooperative efforts of several institutions, including farmers cooperatives, in 3 cases (Italy, India and Egypt); it was performed directly by the government, but it is now moving to the responsibility of farmers' association in Bulgaria.

From the discussion, the following conclusions were outlined:

Milk recording with milk meters (Rome, Italy)

Animal recording is a prerequisite for any serious effort to develop livestock production at

- farm level
- industry level
- national level

Data collected through the recording activities can be used for:

- extension services (feeding requirements, reproductive patterns, pathologies) at farm and industry level
- estimation of Breeding Values, selection of bulls and bull mothers at farm level and national level
- once entered in a national database, these data are a good tool for understanding the production systems and can contribute to making national strategies for buffalo

Five major recommendations coming out from the Buffalo Workshop are here listed:

1. At farmers level:

Farmers need to be made aware of the benefits from the recording activity (meetings

follows page 25

and discussion with the farmers can be organized by the government, cooperatives, research institutions). Farmers may be made aware, through the regular visits of the milk recorders, that they receive technical advise and extension service in management, feeding, reproduction and health. Farmers should be made aware also that milk recording is a helpful tool in decisions on animal culling and selection.
Because many buffalo farmers have a herd of 1 to 3 buffaloes only, they may consider useless to be given management advise about their animals, of which they feel they know everything. In such cases, competitiveness between farmers could be stimulated by ranking buffalo performance in a village, taking the village as a recording unit (instead of a private herd). This would allow the farmers to make comparisons and help them to make husbandry and management decisions.
Provision of initial incentives to smallholders, such as free concentrates, vaccines, semen doses, is also a good means to promote recording activity.

2. At national level
Policy makers should be made aware that sustainable genetic, productive or sanitary improvements in a country or region need to be based on a well functioning milk recording activity.
The governments should provide financial support for the implementation and maintaining of recording systems, at least during the initial stages.
Technical support for the planning and initiation of the animal recording activity might be also requested from International Development Agencies like FAO.
Farmers should be asked to pay for the recording and selection services only after the benefits of the activity have been demonstrated to them.
One good example of a practical solution was given by India, where the farmers who participate in the recording activity sell all their milk to their own dairy cooperative which deducts the costs of the recording and selection activity from the milk payment.

Some partecipants of the buffalo Workshop during the discussion session: N. Van Thu, Ali Nigm, Kays Juma, Munir Chaudry, Omar Faruque, Tigran Chitchian, Davood Kianzad; E. Latifova, B. Moioli, Tz. Peeva.

3. It is necessary to provide solutions to cut down the recording costs through, for instance, simplified, low frequency recording systems; research trials can be proposed and verified.

4. Along with animal recording, **artificial insemination** is a fundamental joint service to guarantee semen of proven bulls to farmers' herds.

5. A milk recording and breeding programme might be also organized within **nucleus herds,** where the stages of the genetic improvement strategy can be more easily performed. In such case, research institutions can be good promoters of the breeding programme because they can offer scientific/technical expertise at all levels. It is recommended, however, that research institutions help to sensitize the policy makers of the importance for the economy of promoting and maintaining an effective recording and genetic improvement scheme.

The Proceedings of the Workshop, including 13 case studies, presentations, discussion sessions, conclusions, recommendations and Guidelines for simplified milk recording in buffalo for low to medium input production systems have been published in the ICAR Technical Series, No. 4, and are available on request to the "Buffalo newsletter".

Bianca Moioli
(Coordination Centre of the Buffalo Network)

3RD ALL AFRICA CONFERENCE ON ANIMAL AGRICULTURE AND 11TH CONFERENCE OF THE EGYPTIAN SOCIETY OF ANIMAL PRODUCTION EGYPT, 6-9 NOVEMBER, 2000

Brief Report on the Joint 3rd All Africa Conference on Animal Agriculture and 11th Conference of the Egyptian Society of Animal Production

For the first time, Joint 3rd All Africa Conference on Animal Agriculture and 11th Conference of the Egyptian Society of Animal Production has been held from 6-9 November 2000, in Alexandria, Egypt. The conference held under the Patronage of the World Association for Animal Production (WAAP) was organized by the Egyptian Society of Animal Production and the Faculty of Agriculture, Alexandria University. Participating organizations included European Association for Animal Production (EAAP); Food and Agriculture Organization (FAO); Middle East Regional Office (FAO, Egypt); International Office for Epizootics (OIE); International Office for Epizootics (Middle East Regional Committee); World Bank; Institute National de la Research Agronomique (INRA); Ministry of Agriculture and Land Reclamation, Egypt; Faculty of Agriculture, University of Alexandria and Cattle Information System/Egypt (CISE).

Under the conference theme **"Optimizing The Utilization of Animal Production Resources in Africa"** 150 scientific papers, case studies and country reports have been presented at seven plenary and nine scientific plus two poster sessions. The conference was attended by 250 scientists from 22 European, Asian, American and African states. Plenary sessions addressed the following topics with emphasis on the African context: Utilization and conservation of Animal Genetic Resources; Range Land and Other Feed Resources; Animal Environment Interactions; Animal Health and Welfare; Biotechnology in Animal Production and Trade of Animals, Feed and Animal Products. A special Session on **"Sustainable Small Holder Animal Production Systems for African Conditions"** was held and attracted most of the conference attendants. Also, special session was devoted to **Graduate Student Presentations**.

The World Association for Animal Production (WAAP) presented an award of US$ 500 plus a recognition plate to the best poster; the second best poster was awarded US$ 350 by the Animal Production Research Institute (APRI), Egypt. Also, two awards (US$ 500 plus a recognition plate and US$ 350 plus recognition certificate) were presented by the European Association for Animal Production (EAAP) and the Egyptian Society of Animal Production (ESAP) to the two best graduate student presentations.

Special attention has been paid to **"Buffalo Production in Africa"**. Borghese and Moioli of Istituto Sperimentale per la Zootecnia of Italy participated with an interesting study on **"Feasibility of Introducing Buffaloes Into Some African Countries"**. The paper presented by Borghese discussed the opportunities of developing buffalo production in Africa with emphasis on problems relating to climatic adaptation, feeding and nutrition and pathology and management. The Authors defined the potential African areas on the basis of: percentage of dairy cows out of total cattle; average annual milk production and change in cattle numbers in the past ten years. The paper emphasized that general physiology, reproduction, health, feeding, management, performance recording and marketing should be carefully considered for successful introduction. It was suggested that a local organization supervises the introductory trial. It should cooperate in planning and supervising all necessary actions for a successful buffalo production system. Other eight papers discussed improving growth, feeding, reproduction and genetics of buffaloes.

A Business Session was devoted to discuss affairs of All Africa Society for Animal Production (AASAP). Dr. Jan Hofmeyer Convenor of the Preparatory Contact Group gave a short review of the achievements towards the establishment of the AASAP. The meeting agreed to upgrade the Contact Group into an Interim Council of AASAP. Terms of reference of the council included discussing of location for a provisional AASAP secretariat and its management arrangements; seeking support of regional research networks; reviewing the draft constitution of AASAP and holding 4th All Africa Conference in 2004 in Burkina Faso.

Ali A. Nigm
Secretary, Scientific Committee

buffalo news - buffalo news - buffalo news - buffalo news - buffalo news - buffalo news

VI WORLD BUFFALO CONGRESS

The VI World Buffalo Congress will take place in Maracaibo, from 28th to 30th May 2001. The event will be under the joint organization of: The International Buffalo Federation, The School of Veterinary Sciences at the University of Zulia, Condes- LUZ and Asobufalo.

The VI World Buffalo Congress is presented to professional and technical staff from the agricultural sector, agriculture students and, in particular, to cattlemen and farmers. The object is to inform the audience of the technical advances that scientists and researchers have achieved world-wide in buffalo production techniques, and how these advances can be translated into more profitable buffalo production at farm level.

Contacts: **6th World Buffalo Congress**

Telephone: **+58 47 410661**
Fax: **+58 47 414643**

E-mail:
6wbuffcong@cantv.net
cportal@telcel.net.ve

Mail:
P.O. Box 70121
Caracas, Venezuela

"Buffalo Newsletter"
Istituto Sperimentale per la Zootecnia
via Salaria 31
00016 Monterotondo, Italy

Do please suggest any people interested in receiving the "Buffalo Newsletter"

Name...
Address...
City, code ....
Country ....

"Buffalo Newsletter"
Istituto Sperimentale per la Zootecnia
via Salaria 31
00016 Monterotondo, Italy

Do please suggest any people interested in receiving the "Buffalo Newsletter"

Name...
Address...
City, code ....
Country ....

Buffalo Newsletter
email: ISZ @ flashnet.it
www.inea.it/ISZ/newnet.htm
Number 15 –February 2001

Editor
Antonio Borghese

Assistant Editor
Bianca Moioli

Network Co-ordination Centre, to which all correspondence is to be sent:
Istituto Sperimentale per la Zootecnia
Via Salaria, 31
Tel. 06900901 - Fax 069061541
00016 Monterotondo
Italy

Typeset
Roberto Bellini
email: ro.bellini@tiscalinet.it

Printed by: ANIS EDITRICE
via Val di Fiemme 16/20
Roma - Telef. 06/8180396

buffalo news - buffalo news - buffalo news - buffalo news - buffalo news - buffalo news

VI CONGRESS PROGRAM

DATE	TIME	ACTIVITY
28/5/01	14:00 – 19:00	Registration
29/5/01	08:00 – 09:00	Registration
	09:00 – 10:00	Official opening VI World Buffalo Congress.
	10:30 – 12:00	Plenary Session I.
	14:00 – 15:30	Plenary Session II. Production systems
	14:00	Buffalo Production Systems in Asia.
	14:30	Buffalo Production Systems in Europe.
	15:00	Buffalo Production Systems in America.
	16:00 – 18:00	Symposiums
	16:00 – 18:00	I Genetics
	16:00 – 18:00	II Nutrition
	16:00 – 18:00	III Reproduction
30/5/01	08:30 – 12:30	Plenary Session III Buffalo breeding experiences in America, Europe, Asia, Africa, and Australia. Lectures: Buffalo farms in different countries. Symposiums IV Buffalo milk production V Milk byproducts
	14:30 – 18:30	VI Buffalo meat production VII: Meat by-products
31/5/01	08:30 – 12:30	Symposiums VIII Marketing IX Social- Economics X Health - XI Draft
	15:00 – 16:00	Closing session

"Buffalo Newsletter"
Istituto Sperimentale per la Zootecnia
via Salaria, 31
00016 Monterotondo, Italy