Buffalo Newsletter

Number 9 - April 1998

EUROPE - NEAR EAST

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

FROM THE EDITOR

In this issue of the Buffalo newsletter we are going to present a strategic proposal for the development of buffalo breeding programmes in the world. The paper by R. Aleandri (page 8) is a good opportunity to start a debate on the genetic improvement of buffalo and on the establishment of links between countries so that this purpose could be pursued (see also the note on "INTERBULL" at page 14). We hope that the mentioned papers will be the occasion to start a discussion group within the Buffalo network, through the newsletter and future meetings.

Giancarlo Rossi

INSIDE THIS ISSUE

6TH CONGRESS ON GENETICS APPLIED TO LIVESTOCK PRODUCTION (WCGALP).

The 6th Congress on Genetics Applied to Livestock Production was held at the University of New England, Armidale, Australia with a participation of over 800 scientists. This congress is organised every 4 years and is attended by the major animal geneticists working on livestock. It is the most important event for animal breeding scientists and for the molecular geneticists whose main research goal is livestock improvement.

The congress lasted from 10 to 16 of January 1998 and was organised in contemporary scientific sessions on the following topics:

- breeding objectives and design of breeding programmes;
- quantitative genetic theory and estimation of genetic parameters;
- QTL identification, detection and mapping;
- computing and information technology;
- animal genetic resources, sustainable development and role of exotic breeds in the tropics;
- developmental genetics, transgenics and reproduction;
- dairy and beef cattle, pig, sheep, goats, buffalo, poultry and fish breeding.

It was the first time that a session of WCGALP was dedicated to buffaloes. This session was chaired by **Charan Chantalakhana**, Kasetsart University, Thailand. An invited presentation was given by **A. Na-Chiangmai**, Thailand Department of Livestock, Bangkok, on 'Performance and cytogenetic aspects of swamp x river crossbred buffaloes', in which the Buffalo project developed by the Thailand Department of Livestock from 1986 onward, consisting in a structured crossbreeding programme of crossing river type buffaloes of the Murrah breed to local female swamp buffaloes was described. The advantage of heterosis for growth, fattening performance and milk was investigated in different generations of crossing and back-crossing (50%, 75% and 87.5% river type). The F1 crossbred (50% river) only exhibited diploid chromosome complement of 2n=49, while the various backcrosses from the F1 showed a ratio of diploid chromosome complements relative to the breed percentage of the cross, for example the 87.5% river type showed a ratio of 1:3.7 for 2n=49:50, which is not significantly different from the expected 1:3. The F2 from the F1 inter-se mating were found to have 2n= 48:49:50 in the ratio 1:2:1; no difference either between 2n=48 and 49 was evident in F2 25% river type or between 2n=49 and 50 in F2 75% river type, indicating that F1 with 2n=49 can produce offspring from both back-crossing and inter-se mating. Results on performance indicate that weaning weight of F2 75% river type is higher than the one of F1 or back-cross 87.5% river type, while no difference between the different crosses was obtained for the fattening performances. Milk yield is higher in the F2 75% river type than in F1, both in terms of daily yield and lactation duration. On the contrary, fat and protein content of the F1 is significantly higher than the F2

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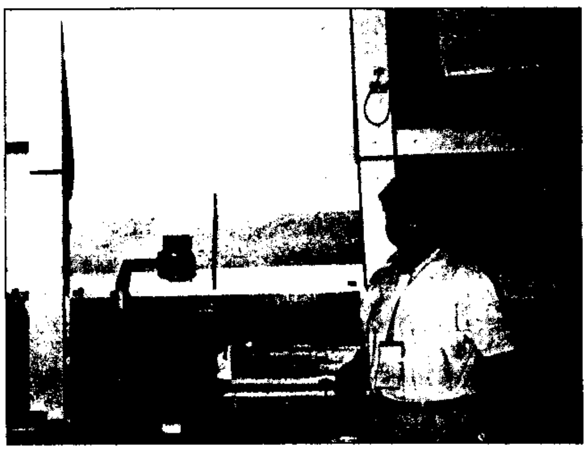
6TH CONGRESS ON GENETICS APPLIED TO LIVESTOCK PRODUCTION

A. NA-CHIANGMAI



A. ROSATI

M. SAJJAD KHAN (ON THE RIGHT) AND CHARAN CHANTALAKHANA

75% River type, which is in line with the difference between the parent lines. Main conclusions of the project is that significant improvent in milk yield and milking ability can be obtained without apparent loss of growth characteristics.

A. Rosati (Italian Breeders Association, Rome) presented a paper on the estimation of genetic parameters for milk, fat, protein and mozzarella cheese production in the Italian buffalo. He analysed 10,663 lactation records using restricted maximum likelyhood by fitting a multiple trait repeated records animal model with a derivative-free algorithm. The average milk yield of the analysed population was 2286.8 kg (sd=492.1), the average fat yield was 196.1 kg (sd=45.6), the average protein yield was 104.7 kg (sd=21.7) and the average mozzarella cheese yield was 589.1 kg (sd=125.4). Heritability estimates were 0.14 for milk yield, 0.11 for fat and 0.14 for protein yield and 0.13 for mozzarella yield. The proportion of total variance due to permanent environmental effects of the cows for milk, fat and protein yield was respectively 0.24, 0.16 and 0.29.

M. Sajjad Khan (University of Agriculture, Faisalabad, Pakistan) referred the results of the genetic evaluation under animal model of Nili Ravi buffalo in Pakistan on the basis of milk records on 5341 lactations of 2507 buffaloes from 4 institutional herds and four field recording centres. Lactation records were adjusted to 60 months age at calving and 305 days duration. Milk yields ranged from 1835 to 2534 kg milk; breeding values averaged 32.2 kg for bulls and 9.3 for female buffalo; genetic trend was negative for the female population and positive for the bulls but this result was suggested to be taken as preliminary because it was estimated only on 50% of the animals, the remaining having no registration for the date of birth. The conclusion was that the negative genetic trend was the consequence of the lack of effectiveness of the selection schemes employed in the past and because Pakistan has millions of smallholders, sustainable buffalo development requires the strengthening of breeding schemes as including increasing of field recording.

S.S. Dhaka (Haryana University, Hisar, India) presented two researches. The first dealt with the relationship between persistency and production efficiency in Murrah buffaloes and considered 538 lactations of 173 buffaloes kept at the experimental farm of Haryana University. Persistency was calculated using several formulas: 1. Ratio of milk yield from day 101 to day 200 out of day 1 to day 100; 2. Sum of the ratios of milk yield at every month of lactation out of the previous month; 3. Ratio of milk yield in the first 26 weeks lactation out of the first 10 weeks; 4. Ratio of lactation milk yield out of peak yield;

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6TH CONGRESS ON GENETICS APPLIED TO LIVESTOCK PRODUCTION

5. Regression of milk records at fortnight interval. Lactation milk yield had a positive phenotipic correlation (0.07 to 0.53) to all 5 measures of persistency, while peak yield had a negative one. Days lactation, and milk yield per day of calving interval had positive correlations with persistency.

In the second paper, S.S. Dhaka presented the effect of non-genetic factors on peak yield and days to attain peak yield in Murrah buffaloes, by analysing the same population as above during 8 years. Peak yield and days to attain peak were significantly influenced by year and season of calving. Winter calvers had significantly higher peak yield than those calving in monsoon. Overall mean values for peak yield was 10.99 (sd=0.15) and for days to attain peak 62.64 (sd=2.79). Parity had a significant effect only on peak yield which increased from first (9.71 kg) to fifth parity (11.74 kg).

Bianca Moioli

CHARAN CHANTALAKHANA (ON THE RIGHT) AND S.S. DHAKA

GENE MAPPING OF RIVER BUFFALO: THE PRESENT STATUS OF THE RIVER BUFFALO GENE MAP

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As mentioned in the previous article (El Nahas, 1997), the physical map for the river buffalo is being developed, using both somatic cell hybrids and direct assignment of genes to chromosomes by in situ hybridization.

Comparative cytogenetics and physical gene mapping have shown that chromosome band homology in related- species is a good indicator of genetic homology, and that chromosome conservation indicates syntenic conservation. In cattle (Bos taurus), the physical map is well established. The genome consists of 29 pairs of acrocentric autosomes, a submetacentric X and an acrocentric Y chromosome. To each chromosome a synteny group has been assigned (Mezzelani et al ., 1994). The genome of the river buffalo consists of five pairs of submetacentric and 19 pairs of acrocentric autosomes, an acrocentric X and an acrocentric Y chromosome.). Chromosome band homology between river buffalo and cattle has been established (Report of the committee for the standardization of banded karyotypes of the river buffalo, 1994). Based on this banding homology, the five submetacentric pairs of the buffalo are assumed to originate from fusion of 10 cattle acrocentrics. Because of the extensive chromosome conservation between cattle and river buffalo, the cattle physical map functions as a template for developing the buffalo gene map.

So far, 57 coding genes and 17 DNA segments (microsatellites) have been investigated to river buffalo chromosomes. Sixteen loci were assigned directly to chromosomes using in situ hybridization (Iannuzzi, 1997) whereas 57 loci were assigned in our laboratory to syntenic groups and to chromosomes using somatic cell hybrids (some loci were assigned by both methods). The investigated markers cover 23 cattle autosomal syntenic groups (U1, U2, U3, U4, U5, U7, U9, U10, U11, U13, U15, U16, U17, U18, U19, U20, U21, U22, U24, U25, U27, U28, U29) each group being presented by two to six marker loci. A syntenic group was assigned to each arm of the five submetacentric and to 13 of the 19 acrocentric buffalo autosomal pairs.

The complete list of markers investigated and their assignments to syntenic groups and to river buffalo chromosomes is in preparation for publication.

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TIME OF MAXIMUM DEGRADATION RATE OF PROTEIN IN CONCENTRATE FEEDS FOR BUFFALO IN COMPARISON WITH CATTLE AND SHEEP

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INTRODUCTION

The use of Gompertz mathematical model for the study of protein rumen degradability, respect to the most used Ørskov and McDonald model, involves the acquisition of more informations on degratative kinetics.
In fact, the Gompertz model always provides a positive value of the initial solubility (t=0) and a variable degradation rate as time passes.
Furthermore, it is possible to obtain either the time of maximum degradation rate or the value of maximum degradation rate.
The aim of the present short paper, carrying on the elaboration of results showed in the 5th World Buffalo Congress (Terramoccia et al., 1997), is to calculate the times of maximum degradation rate of protein in rumen of buffalo in comparison with those obtained for cattle and sheep.

MATERIALS AND METHODS

The trial was carried out on two concentrate feeds: soybean meal (CP = 53.21 % DM) and barley meal (CP = 12.11 % DM) and, for rumen protein degradation trial, on three Mediterranean buffalo bulls (LW = 588 ± 14 kg), three Friesian bulls (LW = 631 ± 25 kg) and three Delle Langhe rams (LW = 90 ± 5 kg).
Each animal, housed indoors and fitted with a silicone ruminal cannula, was fed with a diet constituted by 25% pelletted concentrate and 75% permanent meadow hay at maintenance level (50 g DM/kg.75).
Feed samples, incubated in the rumen at 0 h (3 min in rumen fluid) and 2, 4, 8, 16, 24, 72 h, using the nylon bag technique, and residue samples from incubation were analyzed for crude protein to calculate rumen degradability.
The degradation kinetics was computed by the mathematical model of Gompertz, Y=B*exp(-C* exp(-A*t)) (Lavrencic et al., 1996) using the Marquardt algorithm in NLIN procedure of SAS program (SAS, 1993). The Y of the above equation represented the degraded fraction after time t of rumen incubation; B, the asymptotic value of degradation; C, the natural logarithm of the ratio solubility/maximum degradation value, that was multiplied by an exponential time variable factor containing A; the theoretic solubility (Y at t=0) was calculated as B*exp(-C).
The effective degradability is calculated by the approximate equation P=B*(exp(-C)+A*(1-exp(-C)) /(A+k/0.67)) using k values estimated in a previous paper (Bartocci et al., 1997) for a diet containing a ratio forage/concentrate = 75/25 (k = 0.0242 for buffalo, 0.0282 for cattle and 0.0288 for sheep).
The time of maximum degradation rate (TMDR) was calculated using the second derivative equation of Gompertz function putting it equal 0, solving for t. The value of TMDR, used in the first derivative equation of Gompertz function, gave the maximum degradation rate (MDR).

RESULTS AND CONCLUSIONS

In the first part of Table 1 the parameters of protein degradative kinetics, obtained by the Gompertz model for the two considered feeds and for the three species, are reported.
The determination coefficients of all curves have showed acceptable values (R2 = 0.99) and the residual standard deviation values were enough satisfactory.
The protein effective degradability values (Pk%) of the two feeds incubated in buffalo rumen resulted intermediate between those obtained for cattle and sheep. In particular, the value (81.71 %) obtained with soybean meal for buffalo was 1.08 % lower than cattle and 2.73 % higher than sheep; while the one (81.26 %) obtained for barley meal, always for buffalo, was 1.48 % lower than cattle and 3.58 % higher than sheep.
In the central part of Table 1 the values, both theoretic solubility (%) computed by Gompertz equation and experimental solubility (%) obtained by time zero measures, are reported.
The theoretic solubility values resulted higher except for barley meal solubility in buffalo rumen: for soybean meal, 49, 15 and 48 % higher for buffalo, cattle and sheep respectively; for barley meal a difference between theoretic solubility and experimental one equal to -1, +12 and +18 % for buffalo, cattle and sheep respectively.
In the final part of Table 1 the values of time of maximum degradation rate (TMDR) and of maximum degradation rate (MDR) are reported.
As the soybean meal was concerned, the values of TMDR and MDR for buffalo (2.95 and 4.98) were intermediate between the values relative to cattle (2.58 and 5.87) and sheep (4.13 and 4.93). An inverse trend between TMDR and MDR could be noted.
Regarding the barley meal, incubated in buffalo rumen, a higher value of TMDR (1.73 vs 0.93, 0.87 of cattle and sheep) and a lower value of MDR (5.89 vs 8.21, 7.68 of cattle and sheep) is recorded.
The Gompertz model was tested also on polyphita hay and for all species, the curves had the C parameter < 1; this fact has determined mathematically correct values of TMDR and MDR but not biologically reliable (TMDR very high and MDR very low).

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Table 1. Protein degradation kinetics parameters of Gompertz model

	SOYBEAN MEAL			BARLEY MEAL		
	buffalo	cattle	sheep	buffalo	cattle	sheep
A	0.159	0.162	0.155	0.172	0.242	0.221
B	97.54	96.46	99.56	96.55	98.84	96.56
C	1.506	1.618	1.747	1.547	1.255	1.211
RSD	5.60	5.77	6.12	5.06	2.90	5.96
P-(%)	81.71	82.60	79.84	81.26	83.48	78.45
Theor.solub. (%)	21.55	21.86	17.51	34.34	36.34	36.59
exper. solub. (%)	14.45	16.76	11.70	34.42	35.42	32.59
TMDR (h)	3.98	2.58	4.15	1.75	0.95	0.97
MDR (%h⁻¹)	4.96	5.67	4.95	8.39	8.21	7.66

As conclusion, it can be noted that the utilization of Gompertz model has been positive both for buffalo and for cattle and sheep on protein rumen degradation of concentrate feeds supplying as further information TMDR and MDR not obtainible with the Ørskov and McDonald model.

More attention must be paid when the Gompertz model is used for fibrous feeds with C parameter < 1. This situation occurs when the initial solubility is > 36% of asymptotic value obtained after 72-120 hours of incubation.

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PRESENT AND FUTURE RESEARCH ON BUFFALO IN SYRIA

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Paper presented at the Buffalo Network session in the 5th World Buffalo Conference (Caserta, 12 - 17 October, 1997) - Italy.

INTRODUCTION

Since not much of attention was paid to buffalo development in Syria and since the present rate of dwindling of their numbers may lead to their ultimate extinction, it was necessary to establish the first Centre for Buffalo Research and Development (CBRD).
All the development activities of buffaloes shall be carried out by CBRD with participation of the respective provincial Directorates of Agriculture. Buffaloes are a national heritage of Syria which should be preserved. In the light of this the objectives of this centre can be listed as follows:

A. General objective:

Restoration of buffalo as an economical producer in the traditional buffalo regions of Syria even under the changed land use and farming patterns.

B. Specific objective:

- 1. Conservation of the fast disappearing Syrian buffaloes.

- 2. Study of physical, hysiological and production characteristics of Syrian buffaloes in relation to feeding and management.

- 3. Developing appropriate feeding, breeding, health cover and management systems for the Syrian buffaloes under the hanged land use and farming patterns.

- 4. Extention and training of farmers in scientific buffalo husbandry, organising them for better coordination of stock improvement, feeding and marketing buffalo milk and milk products.

5. Breeding and Reproduction studies
5.1. No clear information is available about either of the two types of Syrian buffaloes (Ghab and Qamishly types). Hence all the production and reproduction characteristics of the buffaloes need investigation.
A. Growth studies:
Birth weight; weight at 3,6,9,12,18 and 24 months of age; body measurements at the same intervals; body weight at first mating also are recorded. The present work on weighing and measuring buffaloes will be carried out in Qamishli region. It is sufficient to record 10 to 15 animals of each age group category. These can be considered as sample for that group.
B. Production studies:
Milk yield recording for full day (morning and evening milkings) once a week; Analysis of milk samples for fat % and SNF % at weekly intervals; lactation length; length of dry period; udder size also recorded in all buffaloes during the second month of lactation.
Note: On the days of milk recording the calves shall be weighed immediately BEFORE and AFTER suckling to know the milk consumed by them. Milk consumed by calves + milk collected in the bucket = total milk yield of the buffalo.
C. Reproduction studies:
Age at appearance of first heat; age at first conception, age at first calving; service period

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(calving to conception); intercalving period; duration of different seasons; symptoms of heat; common reproductive disorders.

D. Meat production studies:
Sample male calves on fattening shall be slaughtered at different ages (1,1 1/2, 2 years) and all slaughter, carcass and meat characteristics will be studied.

5.2 As far as possible such data should be recorded in the farms.

5.3 These records will form the base for ultimate selection and breeding plans. At the beginning selective breeding shall be carried out separately within the Ghab type and Qamishli type buffaloes. Milk yield can be the main goal By the end of 3rd year, when sufficient information on performance is available, the scale and nature of introducing blood of Murrah breed by importing frozen semen can be considered.

5.4 Selected bull calves may be purchased from farmers, reared and relocated in villages so that inbreeding can to some extent be avoided.

- 6. Feeding And Nutrition Studies

6.1 Grazing as a system of feeding buffaloes (a tradition) is becoming more and more difficult in Syria. It should be very limited. Grazing is no longer able to support the nutrient requirement of buffaloes as it is mostly stubble grazing from Feb. to Sep.. Hence there is need to change feeding system. This should first be demonstrated at the CBRD.

6.2 The area remaining after construction of buildings (about 9.5 ha) is put under intensive fodder cultivation using local species and varieties of fodders. The ration is composed of limited quantities of chopped green fodder (10-20 kg per animal) + Urea - treated - wheat (5-8 kg per animal) + combined feed block (2 blocks of 7kg each) could be the ration per day. Lactating and down - calver buffaloes may be given around 2 k.g of pelleted concentrate feed. This ration can provide the dry matter and nutrient requirement of buffaloes. Young calves also are introduced to green fodders and moistened calf-starter feed from 3rd month onwards.

6.3 Information on feeding is recorded at least on group basis. All feeds are analysed including feed samples collected from buffalo farmers.

6.4 All changes in ration are done gradually. As far as possible *in-vitro* or even *in-vivo* digestibility studies are carried out during summer and winter seasons at least on 10 female growing stock and 10 buffaloes.

6.5 As a control, a group of buffaloes also reared on grazing as by farmers and compare the performance of the two groups.

- 7. Health Studies

7.1 All the incidents of illness, their nature, treatment, mortality, are recorded.

7.2 Young animals are dosed every month with anthelmentics for prevention of internal parasites, especially, Faciola and roundworms. Such deworming also done against Faciolasis even in adult animals every three months, at least in the first year.

7.3 All animals are vaccinated against rinderpest (excluding calves below 6 months of age). Hamorrhagic septicaemia (pastruellosis) and Foot and Mouth disease before the on-set of the seasons of incidence.

7.4 Post - mortem exmination also carried out on all dead animals to know the precise cause of death.

7.5 All mated animals are tested for pregnancy diagnosis after the 3rd month by rectal examination. Females failing to conceive by two consecutive matings are examined for any pathology of reproductive system.

7.6 A small veterinary section is established on the farm for the above purpose. This section also gathers information on incidence of various diseases and the local tradiional methods of treatment used.

- 8. Management studies

8.1 It should be realized that at CBRD an intensive system of management is followed as against the extensive (less profitable and more difficult) system followed by buffalo farmers. The idea is to demonstrate to the farmers that under different land use, it is necessary to change the management system so as to cope with less and less scope for grazing wallowing and earn more from buffaloes through scientific management.

8.2 The system of buffalo management followed at CBRD is considered as follows:

a) Stall-feeding using limited greens, Urea / ammonia treated straw, combined feed blocks and limited pelletted concentrate feed. A small group of buffaloes can be maintained under conditions as those of farmers (grazing - based) for comparison sake.

b) In summer showering the animals 2-3 times around noon as compared to wallowing practiced by farmers. plus housing in semi-open houses. The fully closed buffalo sheds are not suitable in this respect.

c) In winter, housing in semi-open houses with partial walls as against housing in totally closed sheds by farmers. d) Undertaking appropriate and timely health care and reproduction management measures.

- 9. Milk Handling And Processing Studies

9.1 A section also established at CBRD for processing of better quality cream, white cheese etc. Farmers also will be trained for quality control in CBRD. Also technology for making Mozzarella cheese may be initiated at CBRD.

- 10. Extension studies

The extension work is the key for buffalo development in Syria this calls for closer links between CBRD scientists and farmers on one hand and with the government on other hand.

10.1 With farmers:

a) Training farmers at CBRD on scientific stock management and feeding;

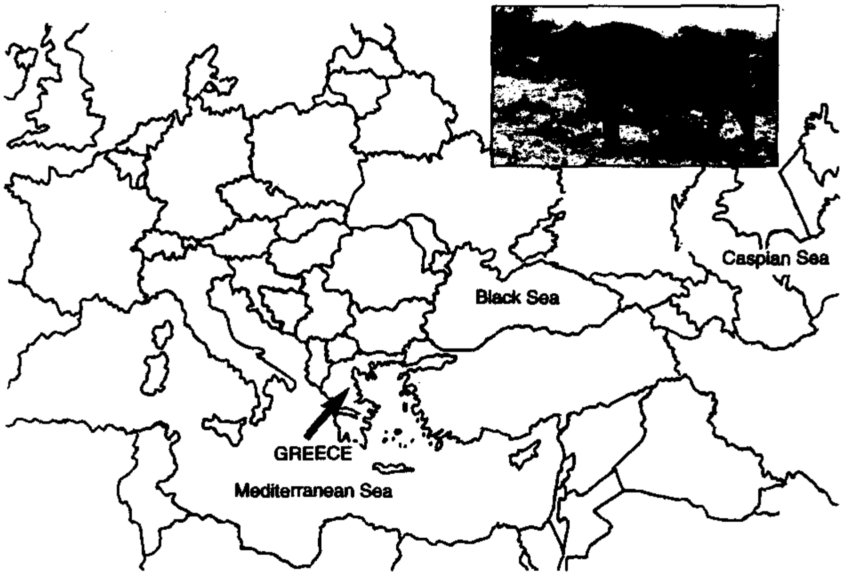
b) Organizing field days, calf and milk yield competitions etc;

c) Distributing pamphlets to farmers describing modern management methods.

d) Opening farmer demo units;

e) Supply of better feed and services, etc.

BUFFALO POPULATION AND PRODUCTION IN GREECE



1 – ORIGIN, TYPE, CROSSING:
Mediterranean breed.

2 – GEOGRAPHICAL AREAS:
Thessaloniki district (Kalachari, N. Apolloniu), Serrea (Omalo, Chrysochoraba), Xanthi, Rodapi (Aratos, Dialampi).

3 – NUMBER IN 1997:
Total buffaloes about 1,000
the number is steady.

4 – RESEARCH HERDS:
4.

5 – DESCRIPTION:
(see table 1)

6 – PRODUCTIVITY:
N. DAYS LACTATION/YEAR:
180-240.
LACTATION MILK YIELD (KG):
kg 700 to 1000.
AGE AT FIRST CALVING (MONTHS):
36 to 48.
AVERAGE LACTATION NUMBER:
9.
AGE AT SLAUGHTER:
male 15/17 months;
female 15/17 months.
WEIGHT AT SLAUGHTER:
male 350/400 kg;
- IS THE CALF SUCKLING?
Yes for 2-3 months in all herds.
- ARE COWS MILKED ONCE A DAY?
No.
- ARE COWS MILKED TWICE A DAY?
Yes, at the farm.
- ARE COWS MILKED BY HAND?
Yes.
- ARE COWS MACHINE MILKED?
No.

7 – FERTILITY:
N. CALVES/YEAR: **0.75.**
SEASON OF CALVING: **end spring and autumn.**

8 – HOUSING:
Loose 100% .

9 – ARE BUFFALOES USED FOR DRAUGHT? No.

10 – SOURCE OF FEEDING:
Graze all year, in winter, concentrates are provided.

11 – TOTAL ANNUAL PRODUCTION BY SPECIES.
Year 1996. (see table 2).
OTHER PRODUCTS FROM BUFFALO:
No.

12 – MILK RECORDING:
No.

13 – REPRODUCTION:
HAS EACH FARM ITS OWN BULL?
Yes.
ARTIFICIAL INSEMINATION?
Not performed.

14 – PERSPECTIVES OF BUFFALO PRODUCTION:
Effords are made by researchers with the support of the government to rehabilitate buffalo production and to let buffalo farming, at present performed for conservation of environment, to become an economic activity.

Stella Stravaridou
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Buffalo farming in Egypt and Syria: n. 3; Bulgaria and Albania: n. 4; Turkey and Romania: n. 5; Iraq: n. 6; Italy: n. 7; Azerbaijan: n. 8.

Table 1.

	ADULT MALE	ADULT FEMALE
- HEIGHT AT WITHERS	135/145 cm	120/140 cm
- WEIGHT	400/750 kg	350/600 kg
- COLOR	dark grey to black (sometimes spotted)	
- HORNS	curved in the lower part	

Table 2.

	N. ADULT FEMALES	TOTAL MILK	CONSUMED FRESH	CHEESE	BUTTER
BUFFALO	600	50,000	50,000		
DAIRY COW	202,000	690,000	?	524,550	5,000
EWES	4,800,000	650,000	?	included in above figure	
GOAT	5,000,000	480,000	?	included in above figure	

FUTURE BREEDING STRATEGIES FOR BUFFALO: POTENTIAL COOPERATION BETWEEN ASIA AND EUROPE

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ABSTRACT

The paper describes the main buffalo populations bred in Asia and Europe with respect to breeding goals and existing breeding programmes. The differences between the river and the swamp populations are discussed.
The use of AI and its importance for buffalo breeding is described in relation to the following activities: a) frozen semen production, b) milk recording, c) progeny test programmes, d) crossbreeding programmes.
Future perspectives for buffalo breeding are discussed both for river and swamp populations. Cooperation projects between Asia and Europe are outlined in terms of possible breeding schemes with common goals.

Key Words: buffalo breeding, buffalo populations, buffalo strategies.

INTRODUCTION

According to the most updated statistics, the world buffalo population is near to 150 millions of animals. About 96% of this population is in Asia. FAO statistics for the decade 1982-92 showed an increasing (1,5% per year) of the world population size.
If we focus our attention on the national buffalo populations with more than 1 million animals (table 1), only 10 countries are included and they are all in Asia, except Egypt. National buffalo populations with size larger than 10 millions of animals are only three: India, China, and Pakistan.
Buffalo populations in India and in Pakistan consist mainly of dairy breeds (river buffaloes); they are increasing with an average annual rate of about 1 and 5 percent respectively during the 1982-1992 decade.
The Chinese buffalo population is mainly used for draft purpose (swamp buffaloes); the population size is increasing with an average rate larger than 1.5 percent in the decade 1982-92. In China attempts are in progress to improve milk and meat production by using crossbreeding of the swamp local populations with river buffaloes.
In Europe (FAO, 1991) total buffalo population consists of less than 350,000 animals; only two countries (Italy and Romania) have more than 100,000 animals. The population size is not increasing in Europe and the buffaloes belong to river breeds.
Main goal of this paper is to identify points of common interest in such a diversity of populations to design future breeding strategies for buffalo.

Table 1. Large (more than 1 million of animals) buffalo populations in the world.

Country	Mill.Head	Country	Mill.Head
India	78.5	Nepal	3.0
China	22.0	Vietnam	2.9
Pakistan	18.2	Philippines	2.6
Thailand	4.8	Myanmar	2.1
Indonesia	3.4	Laos	1.1
Egypt	3.2		

from Sasaki, 1994 (36).

BREEDS IN ASIA AND EUROPE

Buffalo breeds in Asia can be classified according to 3 groups: swamp, river, and the so called desi buffaloes.
Many breeds, types, varieties and even mongrels can be described for each of these 3 groups; but if we focus our attention only on the three large national populations in Asia, then we have: one main breed for the swamp group (the water Ox in China); seven main breeds for the river group (the dairy breeds in India an Pakistan listed in table 2).
The swamp buffaloes (that can be regarded as a unique breed are bred in China and Southeast Asian countries primarily to provide farm power for tillage, transportation and a source of manure for fertilizer; in this production systems milk and meat are only by-products (14).
In Europe there are only buffaloes of the river group; they are dairy animals. The most productive population is the Mediterranean breed in Italy; it has been developed to produce milk for mozzarella cheese (3).
In buffalo populations of Asia and Europe it is essential to consider the difference in the number of chromosomes between swamp buffalo (2n=48) and river buffalo (2n=50). The F1 crosses (2n=49) between swamp and river buffaloes can reproduce themselves, though the fertility of the F1 hybrid males seems compromised (10, 11) and the calving interval is prolonged in backcross generation cows (21). In general the female hybrids (2n=49) are not severely affected by reproductive disturbances (6), whereas the male

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Table 2. Main breeds of the river type buffalo in Asia and Europe; minimum and maximum mean values reported in literature for first lactation milk yield and age at first calving.

BREED	1^ LACT. MILK YELD		AGE 1^ CALVING		REFERENCES
	min mean value (Kg)	max mean value (Kg)	min mean value (mo.)	max mean value (mo.)	
Bhadawari	753	1165	44	55	(14), (39), (24), (18)
Jaffarabadi	1400*	1600*			(17)
Kundi		1781*			(45)
Meshana	1560*	2047			(17), (27)
Murrah	1521	2130	40	55	(16), (28), (7), (22)
Nili-Ravi	1702	3076	41	53	(12), (26), (4), (5)
Surti	1400	2203			(17), (39)
Mediterranean	1321	2560	30	49	(2)

* parity not specified

hybrids (2n=49) tend to be subfertile or sterile. Therefore with respect to the kariotypic differences, the buffalo populations can be divided in 2 male breeding subpopulations: 2n=48, 2n=50; and in 3 female breeding subpopulations 2n=48, 2n=49, 2n=50. This chromosomal polymorphism plays a very important role is designing breeding schemes for the swamp populations by using crossbreeding with the river breeds.

BREEDING GOALS AND TRAITS

To design any breeding programme we need:
- to identify the population;
- to define the breeding goal for the population in a given production system;
- to measure the traits affecting the breeding goal;
- to evaluate the candidates for breeding;
- to select the best candidates and use them to get the next generation.

To keep the overall design as simple as possible three main populations can be identify for the buffaloes: a) river buffalo populations under intensive system to produce milk (RIS populations); b) river buffalo populations under extensive system (RES populations); c) swamp buffalo populations under extensive system (SES populations). A very detailed description of the above mentioned populations can be found in literature (14).

The swamp buffalo population under intensive system has not been considered due to the fact that in such a case the most suitable breeding scheme is the up-grading of swamp population with a river breed both for milk or meat.

Breeding goals for these populations should be defined considering the fact that from each buffalo, for a given period of time (for example 5 years of age), for a given amount of input (for example total energy input), we need to maximize the useful output (for example total milk yield or draught power or manure or meat or a combination of them). We can call $O_{t,i}$ the total amount of output (O), over a period of time (t), for a given amount of total input (i).

The traits useful to express breeding goals must be considered according to their heritability values and genetic correlations among them.

In the literature we can find many different estimates of the genetic parameters for different traits in different buffalo populations.

In table 3 the heritability estimates of the main traits are reported for the river populations.

In any dairy buffalo population to improve $O_{t,i}$ we need, in addition to gain on the output (milk yield), to reduce the age at first calving as measure of the period that the buffalo is not producing, and maintain constant, as much as possible, the weight at first calving as an indicator of the total feed requirement. S.B. Gokhale (personal communication, 1974) reported a genetic correlation between age at first calving and milk yield of -.66 ±.11 and a genetic correlation between weight at first calving and milk yield of .74 ±.09. Recent estimates (33) confirm negative genetic correlation (-.3) between milk yield and age at first calving; and confirm positive genetic correlation (.5) between milk yield and body weight. Such correlation values permit to propose milk yield in first lactation as a single-trait breeding goal for RIS populations.

In addition to an improvement of milk yield, we will also expect, due to the strong negative genetic correlation, a reduction of the age at first calving with a consequent improvement of the total amount of milk at a given age (larger $O_{t,i}$). After few generations we should also expect an increasing of body size due to the strong positive correlations with the weight at first calving. These animals will need more feed to fulfil larger energy requirements due to both milk yield and body size increasing. It is realistic to assume that these extra feeds can be ensured under intensive production systems.

Under extensive production systems the increasing of energy requirements (nutrients demand) for the buffalo raising should be minimized.

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Table 3. Heritability estimates for recorded traits in the river populations.

TRAIT	BREED	H2	S.E.	REF.
1st lact. milk yield	Nili-Ravi	.14	.08	(26)
1st lact. milk yield	Murrah	.22	.05	(1)
1st lact. milk yield	Mediterranean	.17	-	(35)
1st lact. milk yield	Bulgarian Murrah	.12	.03	(33)
fat percent	Murrah	.41	.28	(38)
fat percent	Mediterranean	.18	-	(35)
fat percent	Bulgarian Murrah	.20	.03	(33)
protein percent	Murrah	.74		(32)
protein percent	Mediterranean	.15		(35)
1st lact. lenght	Nili-Ravi	.50	.08	(26)
1st lact. lenght	Murrah	.23	.07	(1)
1st lact. lenght	Bulgarian Murrah	.14	.03	(33)
age at 1st calving	Nili-Ravi	.23	.06	(26)
age at 1st calving	Murrah	.23	.08	(1)
age at 1st calving	Bulgarian Murrah	.25	.04	(33)
weight at 1st calving	Murrah	.35	.06	(1)
weight	Bulgarian Murrah	.51	.07	(33)

Therefore for breeding programmes of RES and SES populations a different breeding goal could be more convenient: to reduce the age at first calving. By selecting for this single trait, indirectly, it will also be possible to improve milk yield (at about half of the genetic gain obtainable through direct selection) and body size, by force of the mentioned genetic correlations.
The slight increasing of body size will also be beneficial for the swamp populations in terms of draught power and total meat, as well as a better milk production and first calving at younger age should improve the total number of calves raised. Of course the importance of reliable estimates for the genetic correlations between milk yields, weight, and age at first calving is evident in drawing conclusions. Very few reliable estimates of the above mentioned correlations are reported in literature for river populations and none for swamp buffaloes. This lack of reliable and updated estimates is mainly due to the absence of good quality recording schemes in RES and SES populations. Data recording schemes are usually the most expensive part of any breeding programme, therefore they should be maintained as simple and cheap as possible without loosing the quality of collected data.
This aspect is the cornstone of any buffalo breeding programme.

DATA RECORDING FOR BREEDING

In 1994 the International Committee for Animal Recording (a technical organisation to which the majority of countries worldwide refers for this activity) began a survey to know the recording activity in dairy buffalo populations. Information were collected from 13 countries (Albania, Bangladesh, Bulgaria, Egypt, Greece, India, Iraq, Italy, Nepal, Pakistan, Syria, Thailand, Turkey). Results were pubblished two years later (29) and are summarized in table 4 for Asia and Europe. For India the reported information referred only to 5 districts of the State of Gujarat where the National Dairy Development Board has begun in 1987 a progeny test programme in small herds. In India there also are about 100 istitutional buffalo herds (32 military farms, 50 state farms, and the remaining belong to research institutions) with recorded animals (31) that, however, are not included in the ICAR report.
In Bulgaria, Egypt and Italy a milk recording system for relatively large size buffalo herds has been carried out for many years. In the other countries, milk recording on routine basis is active only in the research herds; usually the recorded research herds supply breeding stocks to the other herds of the country.
The ICAR report clearly shows that the number of buffaloes recorded in herds with a minimum number of herdmates (the only records useful for breeding purposes) is larger in Europe than in Asia: more than 20,000 in Europe, about 4,000 in Asia.

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Table 4. Recorded buffaloes in Asia and Europe.

COUNTRY	NO. COWS	NO. HERDS	HERD SIZE (NO. H.)		TYPE OF HERD (NO. H.)	
			≥20	≤2	STATION	FIELD
Bangladesh	160	2	1	1	2	0
Bulgaria	885	125	5	120	1	124
India*	13000	13000	-	13000	-	13000
Iraq	250	1	1	0	1	0
Italy	19627	214	214	0	1	213
Nepal	70	2	2	0	2	0
Pakistan	3000	20	20	0	20	0
Syria	540	20	20	0	1	19
Turkey	20	1	1	0	1	0

*Gujarat, 5 districts.

Table 4. Recorded traits in Asian and European buffalo recorded populations.

COUNTRY	CALVING DATE	CALVING AGE	SIRE	MILK YELD	FAT %	PROTEIN %
Bulgaria	yes	yes	yes	yes	yes	yes
India	yes	yes	yes	yes	yes	no
Italy	yes	yes	yes	yes	yes	yes
Pakistan	yes	yes	yes	yes	yes	no

The traits recorded in the 4 largest recorded populations are reported in Table 5.
It is important to underline the fact that protein content in buffalo milk is recorded only in Europe. From a breeding stand point river buffaloes in Europe could move from milk yield to protein yield as main breeding goal. Actually this important trait can only indirectly be improved by selection.
Factors limiting data recording in buffalo populations of Asia have been discussed in literature (42) and they must carefully be considered in designing practical breeding schemes.

FROZEN SEMEN AND ARTIFICIAL INSEMINATION

Frozen semen technology in buffalo has been reviewed by many authors (37) from the pioneering effort to deep-freeze buffalo sperm made by Bhattacharya and Srivastava in 1955 up to now.
From a breeding stand point two parameters assume paramount importance in determining practical selection schemes for buffaloes: a) the average number of frozen doses (AND) obtainable from a bull under a routine sperm collection process; b) the average conception rate (ACR) obtainable by using such doses for artificial insemination under field conditions.

Table 6. Average conception rates in A.I. with frozen semen in buffalo.

No. A.I.	ACR	REFERENCE
3,603	.45	(44)
1.228	.54	(20)
7,957	.47	(34)
1,595	.67	(43)
24,195	.45	(9)

The AND value is affected by bull libido (15); by sperm collection techniques (40); by the characteristics of ejaculates in terms of volume, concentration, and motility; by the semen dilution, freezing, and thawing procedures (9, 40), by the average sperm number per dose (37, 40). Most of the fertility trials with frozen buffalo semen have used doses with about 50x106 sperms (9), but also doses with 30 x 106 motile sperms have been used with good results (37). More experimental efforts should be devoted to define the minimum number of motile cells to put into a frozen dose of buffalo sperm without loosing fertility in artificial insemination.
In literature a wide variation in conception rate results is reported for different trials (37). Conception rate in A.I. can be effected by many factors both from the male side (bull fertility, age of frozen semen, number of alive sperms per dose, type of extender for semen dilution) and from the female side (cow fertility, oestrus, detection, time of insemination). The difficulty of detecting oestrus has been a major factor limiting A.I. in buffaloes (23). Silent oestrus or ovulation not preceded by oestrus is believed to be a common phenomenon in A.I. buffalo programmes; but the efficiency of oestrus detection in many buffalo herds can be largely improved.
In table 6 ACR values in different trials with more than one thousand A.I.s are reported. ACR value varies according to the considered insemination number. An ACR=.40 after first insemination, can arise to ACR=.75 after 3 inseminations (37).
To design breeding schemes the following values can be assumed as realistic: AND=10,000 doses per bull per year; 30x106 motile sperms per dose; ACR=.50 after 2 inseminations.

BREEDING PLANS BETWEEN ASIA AND EUROPE

To design future breeding strategies for buffalo, past experience must be considered. Though concerted efforts have been made for the genetic improvement of buffaloes by national and international agencies, the practical results show very slow rate of genetic gain, below the theoretical estimates (31). The points of weakness in the existing breeding programme need to be identified; practical constraints need to be considered and the proposed solutions have to be realistic.
Asia and Europe are very different in terms of populations and production systems for buffaloes, nevertheless both obtained very poor results in terms of genetic improvement. To better understand the reason of this common failure, it can be useful to list the main points of weakness and strength in Asia and Europe for buffalo breeding.
A common breeding strategy between Asia and Europe should combine, in a synergistic way, strong points to minimize the weak ones.
From table 2 we have 4 populations in Asia and

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1 population in Europe with first lactation records higher than 2,000 Kgs. Among these populations crossbreeding could be used to get heterosis (8) without upgrading one population to the other; in addition genetic evaluation for the A.I. pure breed bulls could be obtained and used to improve the original populations.
As an example, a breeding scheme involving the two most productive river breeds in Asia (Nili-Ravi and Surti according to table 2) and the Mediterranean breed in Europe, is showed in figure 1a and 1b. The proposed scheme is a selection programme for RIS populations; according to this scheme 15 Asian young bulls and 30 Mediterranean young bulls are progeny tested per year. The bull-sires path is the only one to produce genetic gain on milk yield; the cows to get future bull-dams will be selected for the age at first calving in the Asian populations and for milk yield in the European population. The total genetic gain on the populations involved should be computed also considering the selected bulls for natural service. The computation of the expected genetic gain on the 3 populations is complex (46) and it is part of the purposes of this paper.
The proposed scheme requests minimum effort for data collection in Asia; only recording age at first calving for daughters of selected A.I. bulls. This recording needs only 3 data: sire identification, birth date of the cow, calving date of the cow.
The number of recorded animals in Asia can be flexible and it will determine only the magnitude of selection intensity for the dam of sire path with no effect on the sire of sire path. The scheme in figure 1 assumes that all the daughters of A.I. bulls are recorded for the trait age at 1st calving. In this scheme the whole size of operations, for the Asian populations, is fixed by the magnitude of n=number of cows to be inseminated by each proven bull (in figure 1b: n=1,000); if we change n-value, all parameters marked with * in fig. 1b will change as consequence.

SWAMP POPULATIONS AND CROSSBREEDING

Crossbreeding of swamp females with river bulls has been adopted in many SES populations to increase body size and milk yield. Positive results have been reported in China (47), in the Philippines (30) and in other Southeast Asian countries (13), in terms of size, meat and milk gains for F1 crosses.
Nevertheless crossbreeding programmes involving swamp buffaloes seem beneficial only if the final goal is the complete upgrading of the swamp population to a river breed. In other words the use of crossbreeding should be considered a genetic improvement tool in swamp populations only if we want to transform such populations into a RIS populations as shown in figure 2. On the other hand, to genetically improve SES populations, breeding schemes dealing with additive genetic variance need to be set up. As stated in previous paragraphs of this paper, the most limiting factor is the absence of good recording schemes in SES populations.
For breeding schemes in SES populations this paper proposes age at first calving as single-trait breeding goal, very cheap and feasible to collect under practical conditions. To apply the breeding scheme proposed in figure 1b to a SES population, it would be enough to organize one or more state farms (in China for example) with a minimum of 2,000 recorded cows for age at 1st calving, and all inseminated by 20 swamp bulls to be progeny tested. The remaining part of figure 1b is identical.

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Region	WEAK POINTS	STRONG POINTS
Asia	**1.** Unclear definition of the trait to be considered as main breeding goal for RES and SES populations; **2.** Poor recording schemes; **3.** Very small effective population size for RIS populations; **4.** Practically zero as effective population size for RES and SES populations; **5.** Poor control of the crossbreeding programs at the population level.	**1.** Very large genetic resources as populations size and genetic variability; **2.** Good level of applied technology for A.I.
Europe	**1.** Small populations in terms of total size; **2.** High risk of inbreeding if A.I. of proven bulls will increase; **3.** Low percentage of A.I. use due to shortage of available proven bulls.	**1.** Good recording schemes; **2.** Large herd size in the recorded herd; **3.** Effective population size with a high potential of growing.

Figure 1.a A cooperative breeding scheme between 2 RIS populations in Asia and 1 RIS population in Europe: the operational size of the scheme is defined according the actual recorded population in Europe.

In Europe:

- breed: Mediterranean;
- total no. recorded cows: 20,000;
- % A.I. in the population: 30%;
- effective population size: 6,000;
- % up grading to Asian population: 33% effective pop.;
- % up grading to Asian population: 10% total pop.;no.
- Asian bulls progeny tested per year: 20 x k;
- no. Medit. bulls progeny tested per year: 40 x k;
- avg. conception rate after 2 A.I.: .50;
- avg no. daughters x bull: 25÷20;
- avg. no. doses x bull per year: (200÷300) x k;
- avg no. doses yearly imported from Asia: (4,000÷6,000)xk;
- proportion of Medit. bulls selected as sires of sires: 1/8;
- proportion of Asian bulls selected as sires of sires: 1/5;
- proportion of Asian bulls selected as sires of dams: 1/2;
- k=365/ (avg. calving interval): ≅.76.

Figure 1.b A cooperative breeding scheme between 2 RIS populations in Asia and 1 RIS population in Europe: the operational size of the scheme is defined according to the actual recorded population in Europe.

In Asia:

- breeds: Nili-Ravi, Surti;
- no. of proven bulls for A.I.: 10=5x2breeds;
- * total no. of cows to be bred by A.I. every year (NAI): n=2,000 cows x 10 bulls=20,000;
- avg. conception rate (CR) after 2 A.I.: .5;
- avg. rate of survival (Sc) from birth to 1st calving: .6;
- * total no. of cows to be recorded (RC) for the trait "age at 1st calving" every year: = 3,000 = NAI x CR x .5 x Sc;
- * proportion (P1) of recorded cows selected as dams of sires: 20/3,000 = 1/150;
- proportion (P2) of recorded cows selected as dam of natural service bulls: 1/3;
- avg. rate of survival (Sm) from birth to sexual maturity of natural service bulls: .6;
- * no. of selected bulls for natural service as sons of the selected proportion (P2) of recorded cows: 300 = RC x .5 x P2 x Sm;
- * avg. no. of doses per bull per year: 200-300 for Europe 4,000-5,000 for Asia

(if selected after progeny test in Europe).

Figure 2. Up grading of a SES (Swamp under extensive production system) population to a RIS (River under intensive production system) population.

GENERATION	MALE		FEMALE	
	POPULATION	CHROMOSOMES	POPULATION	CHROMOSOMES
F_0	RIS	50	SES	48
F_1	RIS	50	↓	49
F_2	RIS	50		49
↓	↓	↓	↓	50 ↓
F_n	RIS	50	RIS	50

NILI-RAVI SEMEN COLLECTION AT QUADIRABAD, PAKISTAN.

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INTERBULL AND THE BUFFALO NETWORK

B. Moioli, Coordination Centre of the Buffalo network

The International Bull Evaluation Service, known as Interbull, was established in 1983, as joint venture between the European Association of Animal Production (EAAP) the International Committee for Animal Recording (ICAR) and the International Dairy Federation (IDF). Main tasks are the collection of pedigree and genetic indices, the initiation of research projects and the improvement of international comparisons of bulls of dairy breeds all over the world. Interbull is also a research centre, reference point for researchers of all countries.

Interbull does not produce bull ranking but information allowing to compare bulls at international level and can be used differently according to the specific selection goals of each country.

In August 1996 the fourth official Interbull evaluation was produced, which was based on the Multitrait Across Country Evaluation (MACE) procedure. According to this procedure, a set of bulls with maternal sire and dam in common is progeny tested in several countries, providing in this way the connection between the bull rankings of different countries. It is therefore possible to compare at international level bulls that have been evaluated only in one country. The following countries have participated in the MACE: Canada, Danemark, Finland, France, Germany, Holland, Italy, Norway, New Zealand, Sweden, Switzerland, United Kingdom and United States. A number of 68712 Holstein bulls with daughters in at least 10 herds contributed to the MACE.

In 1991 Interbull became an independent agency, located at the Faculty of Agriculture of the University of Uppsala (Sweden). The Council of the European Union has officially recognised Interbull on 23 July 1996 stating that the Uppsala centre is the reference point for the standardisation of methods and the results of the genetic evaluation in cattle. At Uppsala data relevant to over 80,000 bulls (Holstein, Brown Swiss, Ayrshire, Guernsey and Jersey) from thirty three member countries are processed. Georgios Banos and Freddy Fixe are the two full-time scientists working for Interbull. There is a Steering Committee which meets regularly to discuss Interbull organisation and propose changes or innovation. The Steering Committee is composed of nine members, representing the geographical areas where Interbull works.

THE BUFFALO NETWORK IS VERY INTERESTED IN THE ACTIVITY OF INTERBULL.

In fact, several member countries of the Buffalo network have pointed out their need to use buffalo semen from other countries (Cairo meeting of the Network, October 1996). Because the exchange of semen between countries cannot avoid considering the different bases on which genetic evaluation is done, the coordination centre has decided to ask some Interbull experts to examine the situation of buffaloes in Europe and the Near East and to make proposals for allowing international exchange of semen and international comparison of buffalo genetic merit. Considering that dairy cattle breeding has reached globalization all over the world, the question is whether buffalo breeding has the same potential. An Interbull expert panel composed of F. Canavesi,, F. Miglior, E. Santus, M. Cassandro and A. Rosati has presented proposals on Water buffaloes: international exchange and comparisoni at the meeting of the coordination board of the Buffalo Network, held at Caserta (Italy) on 13 October 1997. The meeting was attended also by officers from FAO and EAAP.
Considering that 1. some of the member countries of the Buffalo network have their own plans for milk recording and selecton and data are filed at national level (Azerbaijan, Bulgaria, Egypt, Iran, Italy and Romania), 2. that the total number of adult breedable females is about 2,000,000; 3. that AI is performed in most countries on part of the buffaloes; and 4. that the selection objective is milk production in all countries, the proposal of the Interbull panel are to identify a group of countries interested in a project of this kind; to promote the exchange of information among the countries through meetings and surveys. The opportunity of creating a common record layout must be immediately considered: identification of the animals must be unique in the data file and pedigree file of all countries. The exchange of data must be allowed via Internet. In order to establish relationship ties and connections among countries, a well planned germplasm exchange must be established: it is suggested to create specific working groups within the network to cope with the details of the standardization of data and requirements. It is important that Herdbooks of different countries agree to grant reciprocity, in order to facilitate germplasm registration: the non-full reciprocity existing in dairy cattle Herdbooks has slowed down the international exchange in dairy cattle business. It is very important that for every kind of germplasm (semen, embryos, live animals) precise health standards be specified. In particular, the list of diseases that must be absent must be available and accepted. The steps that the WG will have to follow when defining the project will be: the definition of a selection objective; the accurate identification of the animals and its own ascendants; the accurate performance recording; the correct run of the genetic evaluation; the definition of a total merit index and the definition of a selection scheme.
Biotechnologies will be used to promote the exchange of germplasm (semen freezing, ET, Ovum Pick Up).
Standardization of basic parameters should be tackled as first step: lactation length, lactation projection, suckling calf; the test day model might solve some issues by simplifying the recording method. In conclusion, it is necessary to emphasize that the establishment of international comparison is a lengthy process (it lasted more than 10 years in dairy cattle) but it is a necessary step to be done in order to achieve genetic improvement.
Following the proposals of the Interbull expert panel, a working group was created within the Buffalo network, to examine the practical aspects to be solved to implement the project Exchange of buffalo semen and reciprocal genetic evaluation in the member countries. The group will consider the number and the location of the female populations to be used for insemination, and the number of bulls to be tested. The group will carefully check also the sanitary standards by examining all laws and requirements at present in force.
The newly established working group pointed out that the network should take advantage on the activity of Interbull: the necessary harmonization of the parameters must be strongly considered but it is possible also to start with an immediate exchange of buffalo semen to be used to inseminate the top milk recorded cows of each country.

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The republic of Macedonia has joined the Buffalo network. National coordinator is Prof. Kole Popowski, Institute Veterinary Medicine, Lasar Pop Traikov st. 5-7. Skopje, Macedonia. Fax 0038 991 114619. E-mail:
<vetinst@unet.com.mk>

The next Meeting of the coordination board of the Buffalo network will be organised at Antakya, Turkey, in September 1998. Contact the Coordinator of the network if you have proposals for the Agenda.

International Conference on Animal Production organised by the Pakistan Association for Animal Production (2/5 December, 1997)
The coordinator of the Buffalo network (Europe-Near East) Prof. G. Rossi was invited by Dr. Muhammad Aftab Khan, chairman of the Pakistan Association for Animal Husbandry (PAHA) to participate in the International Conference on Animal Production (ICAP) organised by PAHA in order to present the perspectives of buffalo production in Europe and the Near East. Theme of ICAP was Livestock Production in Pakistan: vision 2015. This invitation was highly appreciated because it shows the will of PAHA to cooperate with Europe and the Near Eastern countries. In Pakistan buffalo production is extremely important, being buffalo the most important livestock contributing to over 60% of milk production. Because previous engagements did not allow G. Rossi to go to Pakistan, B. Moioli, head of the Genetic Division of the Animal Production Research Institute of Rome was happy to attend the conference at his place. The ICAP took place at

Islamabad on 2-3 December; participants from the government of Punjab, FAO, Universities, research institutes, milk producers, feedstuff producers and farmers attended the conference. Main discussed topics were the conservation of indigenous genetic resources, breeding schemes for buffaloes and dairy cattle, breeding schemes for evaluating different buffalo breeds over the world, livestock production in marginal lands (desert and mountain areas). After the conference B. Moioli was kindly offered the opportunity to visit the Livestock Production Research Institute at Bahadurnagar, near Okara, directed by Dr. Ashgar, the semen production unit of Qadirabad, and a few buffalo farms in the Okara and Faisalabad districts participating in the buffalo progeny testing programme and was assisted all the time by efficient researchers ready to answer all questions and never tired to describe their activities. The coordinator of the Buffalo network would like to thank again the Pakistani hosts for their insuperable hospitality.

During the **XXth Meeting of the International Committee for Animal Recording (ICAR)** held in New Zealand in January 1998 it was decided that the coordinator of the Working Group on Buffalo Recording will be B. Moioli, of the Animal Production Reseach Institute of Rome who had already cooperated in establishing the group three years ago. ICAR is an international organization officially appointed for standardization of animal recording. Member countries have to conform to the recording regulations issued by ICAR and are then allowed to use an official mark on the record (e.g. on the certificate of lactation milk yield) which is recognized all over the world. Among the member countries of the Buffalo network, only Egypt, Bugaria, Greece and Italy are members of ICAR. One of the priorities to be tackled together by the coordination board of the Buffalo network and the ICAR working group will be to review the draft of regulations for milk recording in buffalo submitted two years ago (published in the Buffalo newsletter no.4, page 5) and to put it into force looking for an implementation of this activity in the member countries of the Buffalo network. In the coordination of the WG B. Moioli will strictly cooperate with Dr. K. Trivedi of the National Dairy Development Board of Anand (Gujarat State, India) who is already the coordinator of the ICAR Task Force "Development Fund" in order to promote all actions related to animal recording. Do contact B. Moioli at the "Buffalo newsletter" address for information, questions, suggestions etc. on buffalo recording.

The annual report (1996-1997) of the "Biotechnology Laboratory" of the National Dairy Development Board, Anand, India is ready. Interesting results on its activities aiming to the genetic improvement of buffaloes are reported. Request a copy to Dr. Singh, National Dairy Development Board, 388 000 Anand, India.

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