
A case study on Buffalo recording and breeding in Iran

D. Kianzad

Animal Breeding Centre, P.O. Box 31585-963 Karaj, Iran

There are 519 000 buffaloes in Iran. The buffalo farming system in Iran is based on smallholders (99 percent); most of the herds have an average of five animals; a few herds have a number of buffaloes between 20 and 50; some of them have 300 buffaloes. Smallholders manage their animals according to the opportunities offered by the environment: pasture, stubble, shrubs and grass. Most of them get their feeding by grazing along water sources: streams, rivers, ponds, lakes, plus the following by-products: citrus peels and pulp, sugar-cane wastage, etc.

In Khuzestan, buffaloes are raised outdoors throughout the year; in the north-west they are housed in autumn-winter.

Buffalo farming in Iran can be considered of a good level because a) owned or rented properties are of a large size; and b) susceptible land for buffalo farming is also large. Buffalo farming has been a traditional activity for many decades.

A project for buffalo development and improvement was started in 1993 and is still being carried out in Iran. At present there is a project on "expansion of buffalo" from the traditional 8-16 provinces, after having considered environment as well as employment opportunities.

The traditional eight provinces are the following: Khuzestan, West-Azerbaijan, Lorestan, Gilan, East-Azerbaijan, Ardebil, Mazandaran and Golestan.

The provinces in which the project aims to increase the number of buffaloes are the following: four provinces with a number of buffalo heads at present ranging from 500 to 1 000 buffaloes: Elam, Fars, Kermanshah and Zanjan.

**Briefly
characterise
the buffalo
recording
system in Iran**

**Overall input
level of the
production
environment**

Four provinces with a number of buffalo heads at present ranging from 100 to 500 buffaloes: Hamadan, Kurdistan, Sistan and Boshher Baluchistan. Transportation of surplus buffaloes from traditional to new provinces has already started.

In conclusion, looking at feeding, health conditions, breeding management, marketing of products and also standard of living, buffalo farmers can be included in the intermediate social class. Following the present policy of extension of buffalo and development of recording systems, an increase in the production level to be achieved in the short-term, is expected.

Approximate number of herds involved in the milk recording activity

At present there are 800 recorded buffalo herds (0.8 percent of total herds); 150 more herds are foreseen in the project for buffalo expansion. The approximate number of milk recorded buffaloes is 14 000 (plus 1 000 buffaloes in the project for expansion).

Animal categories involved in the recording process

According to the type of record:

- milk production and reproduction parameters in all females;
- weight and conformation for meat production in experimental farms for adults and offspring of both sexes;
- reproduction parameters in males after puberty;
- genealogy records;
- culling records, sales, vaccines, diseases, etc.

Purpose of recording systems

At present, on farm management (health and breeding decisions, vaccines, etc). At national level: identification and recognition of different types of buffaloes, Kuhzestani, Azari and Mazandarani for milk production potential, beef potential and reproductive potential; description of all management systems, including feeding, animal marketing, marketing of products, breeding decisions (replacement and culling, choice of breeding bull).

Once an adequate number of records is available at national level (10 000-12 000 lactation records) we plan to process them at central level through the calculation of least square means, breeding values, heritabilities, repeatability and variance components.

Our strategies are based on the following three sections:

- determining the response to the selection on economic traits and decision on the level of achievement of genetic progress in the three populations.
- If the response to selection is positive, we will go further.

- If the response to selection is not positive, we will try to use interbreeding between different types and exotic breeds from suitable zones and cross-breeding through a severe control process. The word “interbreeding” is used because the three types of buffaloes at present reared in Iran (Khuzestani, Mazandarani and Azari) are considered different breeds on the basis of their phenotype. By exotic breeds, the river type buffaloes reared outside of Iran is intended.

The final purpose will be to distribute the best genotypes to overall population of each type, with the help of artificial insemination. Based on our breeding strategy, the distributed top animals will be one to five percent of the overall population.

Eartagging is the most frequently used; if lost it is repeatedly implanted with a new eartag or tattoo; neck collar, used for calves until 6-9 months; belt or rope with numbered label; in tied systems, single stalls are numbered.

Type of animal identification employed

The phenotype of each animal is described in the record: horn shape, white spots, other. Each animal is identified by name of the owner, dam and sire, village of birth. In experimental farms, in some cases, the animal number is applied with the cryogenic method.

Milk and fat are recorded monthly in fields (villages).

They are recorded daily or weekly in experimental stations, if necessary. Protein are only sometimes analysed (mostly in stations). There are three buffalo experimental stations in Iran:

1. Jabal Station at Urmia (West-Azerbaijan) with 300 buffaloes.
2. Safiababad Station at Dezful (Khuzestan) with 200 buffaloes.
3. Mollasani Station at Ahwaz (Khuzestan) with 100 buffaloes.

Frequency of recording

No recording at village level, except in some cases, guessed weights and measurements with an iron yard. In experimental stations, buffaloes are weighed at birth, 1-2-3-4-5-6-7-8-9-12-18 months and maturity.

Growth and beef conformation

Occurrence of first estrus, age at puberty, time of first insemination, estrus occurrence, date of natural mating or of insemination are usually recorded. In villages date of dry off, date of calving, calving type and conditions, in some cases conception date are recorded. In stations the previous parameters are recorded in addition to the length of post-partum anestrus, length of estrus in daytime, days open, number of services per conception and reproduction efficiency.

Reproductive traits

Health records

In villages: for occurrence of special diseases.
In stations: for resistance to diseases (duration of treatments); type of treatments; resistance to treatment or vaccine.

Body conformation scoring

Not at village level. In stations, females are scored at birth, before first mating, heifers, at first lactation, at third and over lactation. Males are scored: at birth, 12 months; puberty; maturity and when necessary.

Other information: feeding

- Feeding in villages:
 - the number of days grazing;
 - type of administered by-product;
 - feed supplements by hand: barley, wheat bran, straw, oil cakes.
- In stations:
 - standard feeding with simulation on labels; control of ingested residual feedstuff; growth rate; and calculation of feed efficiency index.

Pedigree

- In villages: because of natural mating, only the mother of the progeny was recorded (the sire, only when available); at present, both mother and sire are recorded. Other records include herd, birth date, body colour and spots.
- In stations: both dam and sire are recorded.

Analysis of crude data

On-farm, the technician is given the list of the animals of the herd with indication of the last event (calving, dry-off). List of lactating buffaloes with indication of last event: number of day tests; milk/fat yield up to the present day test; total milk/fat yield of previous lactations; average lactation duration, average number of days dry, average days open, both individual and for the herd.

The list is prepared by the deputy of livestock affairs of each province; the Animal Breeding Centre of Karaj provides the scheme and the forms to be conformed to the national system. The Animal Breeding Centre of Karaj is also the supervisor of the performance recording in every province. All forms are computer printed. Overall advice on culling and selection for economical purposes.

The advice is given through several printed forms:

- a. average productive and reproductive parameters for each herd (the signature of the directorship of the Animal Breeding Centre is given on each farm);
- b. monthly report for each herd: list of buffaloes with last event, productive and reproductive parameters of each buffalo;

- c. reports at different dates (yearly, quarterly, every six months) with a list of best/worst buffaloes of each herd, village, town, city and province.
- Regional reports: a description of breed characteristics on the following parameters: frequency of culling, drying, dystocia, calving conditions; average values of milk productivity and reproduction patterns; indication of peculiarities. Regional reports are prepared according to the needs of each province.
 - At the central location: beyond the already mentioned records, weights and morphology are registered. The co-efficient of inbreeding is also calculated. Calculation of composite herds and standards lists on animal and herd. The co-efficient of inbreeding is calculated only for herds where pedigree registration of the sire is effective (Khuzestan province and part of Lorestan Ardebil and West-Azerbaijan).
 - Calculation of genetic parameters: the breeding values are calculated for sires and dams from half-sib records.
 - Genetic trend and genetic progress for all traits in the total population.
 - Determination of animal breeding strategy for total population.

All recorded data are sent to the Animal Breeding Centre of Karaj and stored in a data bank. The Animal Breeding Centre has a self-designed programme for:

- transfer of data;
 - data filtering: e.g. date of dry-off must fall after insemination, etc. (errors are indicated by special code); and
 - final reports on productive/reproductive traits.
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- Data input, print and data calling;
 - reception of data from provinces;
 - final control file for printing and merging with analysis files;
 - report printing (preparation of all forms for on-field data recording);
 - option menu: all types of data selection, preparation of data files, preparation of descriptive statistics, pedigree updating, breeding values updating, correction);
 - guide board.

The project is designed to support smallholders through extension, education, increasing of recording, increasing of awareness and improvement of structures and management. Therefore, support is given by giving the farmers animal feed concentrates, barley, wheat and provision of semen, as well as help for disinfecting and rebuilding of the structures. Also long-term loans are provided at low interest.

Computerisation of data

Description of Animal Breeding Centre computer system

Government and farmer involvement

Level of acceptance

Accepted in areas where buffalo production is economically very important (first agricultural activity, or second, after crops).

Accepted at different levels according to the education level of the farmers. Production efficiency of the area: farmers of higher milk/meat productivity tend to more easily accept the protectional project scheme.

Payment of recording

- Official recording system, based on Government staff (agents and technicians). All executive functions are performed by Government technicians. This staff is appointed by the Deputy of Livestock, Ministry of Agriculture and covers by the whole country. They are trained by the experts of the Animal Breeding Centre.
- Non-governmental system
 - records are performed by the buffalo owner (but also mostly promoted by farmers in each region).
 - Local cooperatives of farmers.

In both cases, executive operations are supervised by Government staff under the control of the Animal Breeding Centre, which has several branches in all provinces. The system is submitted to modification, according to special requests from particular areas (e.g. number of available animals in the most remote areas).

At present, all costs of the recording activity are borne by the Government, but it is planned to shift to the private sector in order to extend recording, provide occupation opportunities and decrease Government costs.

Genetic improvement programme

We have an on-going programme which is now at the end of the stage of recognition. At this stage we are able to determine the production potential of the population for any economic trait and therefore, we know the best dams and sires to be introduced into the whole population.

Buffaloes officially recognised as being of higher genetic merit

In Kuhzestan we have recognised over 100 female buffaloes with a test day milk yield of 27 kg (not including the suckled milk, therefore, if the intake is included, yield gets higher). Last year in Kuhzestan 20 bulls and 100 females were officially evaluated in the herds participating in the recording project (ONBS). Evaluation is performed every year. Year after year accuracy of evaluation increases. According to our forecast, the number of buffaloes to be evaluated in the near future, including other provinces, will be increased four to five times (i.e. 80-100 bulls and 400-500 females).

System of establishing genetic merit

We have four different methods:

- a. Test day method: in this method, only the three test days of each lactation with the highest milk yield are taken into account.
- b. Least Square Mean of the test day peak in total lactation. Selection is based on corrected test peaks (selection goal is the peak of milking).

- c. Lactation milk yield in the first 200 days lactation, based on average production and persistency (selection on milk yield).
- d. Least square means of lactation milk yield in the first 200 days (selection on corrected milk yield).

For prediction of breeding values, at least one complete lactation with three to seven tests is requested.

Important: to each method, an adjustment co-efficient is applied accounting for environmental conditions. The following factors are considered for the calculation of the adjustment co-efficient: feeding level, health status and level of education of the farmer. Then a final index is given to every buffalo with a list ranking the buffaloes. Separate lists are printed according to the employed evaluation method (three day test of 200 days lactation).

All rearing conditions and possible environments are studied finally with type evaluation on the main productive traits. Selected buffaloes are examined and finally confirmed and their male offspring are transferred to the stations.

- a. LSM: at first, test of co-variance for pre-correction of correlated traits is carried out. Secondly, a model for adjusting non-genetic factors (age of buffalo, number of lactation, herd/year/season effect) as well as dam and sire effects (genetic) is applied. Finally, values of estimates of LSM of each trait are used. At this stage, we still need more information about pedigree of animals, mainly the sires and the relationships between dams, therefore, the method is applied only for calculating the correction factors and not for genetic evaluation.
- b. Genetic evaluation method.
 1. Test of normality by K-S test (Kolmogurov-Smirnov) or median, mode, mean, skewness and kurtosis are calculated for assessing normality of distribution of dependent variables.
 2. Determination of rate of significance for any independent traits and combination of the traits (with single or multiple regression, by ENTER or STEPWISE methods).
 3. Study of combinations between variables: interaction effect, polynomial effect, for example: season*year or season*herd or herd*year; weight:sire or weight:breed, linearity or non-linearity.
 4. Input of significant traits into final true model with the above-mentioned fixed and random effects.
 5. Solution of the designed model by Harvey 90, PEST, SAS, JAA, REML, DFREML.

Determination of LSM and BV for each animal and adjustment co-efficients for fixed effects. In the areas where sires are not registered, evaluation is made by the regression dam-daughter.

Description of evaluation methods

Minimum number of requested records:

- for method of lactation milk yield in first 200 days: two lactations;
- for method of three test day peak: 20 tests;
- for analysis of population, minimum 4 000 completed lactations and minimum 28 000 recorded day tests.

Responsible organization for the genetic evaluation

- a. Animal Breeding Centre, Karaj with following staff: one technical deputy; one responsible for buffalo section, one staff member for data input in computer.
- b. Deputy of Livestock Affairs in Tehran (Central office): buffalo section, one person.
- c. Provincial executive branches: one responsible person for the project in each province, plus local staff according to the number of herds and buffaloes (recording operations, registration, etc.)

Distribution of genetic improvement all over the country

- a. With AI since the beginning of the buffalo project, 35 top bulls have been used in AI centres and 7 200 buffaloes were inseminated with fresh semen. At present, 1 800 buffaloes are inseminated every year with frozen semen. There are six AI centres in Iran.
 1. Jabal (West-Azerbaijan, 30 km from Urmia, on the road to Mahabad). It has 15 breeding bulls producing 8 000 frozen semen doses per year.
 2. Bardieh (Khuzestan, at Susangerd). It has three bulls that produce fresh semen to cover the needs of 100 herds (1 000 buffaloes) in the villages around Susangerd.
 3. Daravizeh (Khuzestan, at Ahwaz) will soon be operational (the breeding bulls are at present being selected). It will keep 30 breeding bulls every year. It will cover most of the semen needs of Khuzestan with fresh semen. The top selected bulls of Khuzestan will be transported to Jabal for producing frozen semen.
 4. There are three more stations for supportive research purposes: Sardrood, Safiabad, Mollasani.
- b. In natural breeding stations for the herds located near the stations.
- c. With natural mating within the herds and sale of best animals made by stations and large herds (over 50 buffaloes) that have been recognised by the Animal Breeding Centre.

No genetic improvement programme has ever been established in the past.