Development of Buffalo breeding scheme in Thailand

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Buffalo recording system in Thailand

In South-east Asia, Thailand had the largest swamp buffalo population but has lost a considerable number with a negative annual growth rate of -17.34 percent per year since 1995. The number of buffalo has decreased every passing year (Department of Livestock Development, 1999); the present number is about 1.3 million and tends to decrease gradually. Sixty percent of the Thai population belongs to small-scale farmers who raise buffalo in the back yard. It was an integral part of the crop production system. The breeding units of buffalo per family hold on average five to ten heads from which no economic profit is made. There are very few farms that keep buffalo up to 50 head and manage as a commercial system where animals are fed good quality feed as well as having good management. Buffalo breeding in village conditions is generally random mating. In fact, in the plantation season the buffaloes are tied up and fed with rice straw for almost four months resulting in a lack of opportunity to be bred during the plantation time. The animals, males and females, are grazed together in the paddy fields after the harvesting season. Consequently, unplanned breeding occurs during the harvesting time when the villagers let the buffaloes graze together. It is obvious that in general, there is no recording system approach to the farmer level as in Government farms.

Regarding the Government breeding improvement point of view, in 1981 the National Buffalo Breeding and Research Programme in Thailand was established. The goal of the programme was to define the genetically superior buffaloes for sires and dams to be used and disseminate their merit to the farmers' animals. Buffalo breeding herds were set up at two stations at the beginning and then expanded to seven Government stations. The Lamphyaklang Livestock Research and Breeding Centre, in the central

part of the country was established as the central test station where the performance testing programme was conducted as the selection tool for the buffalo improvement programme.

The Department's annual budget for those seven stations is currently around 35M Baht. There are 1 200 breeding buffalo cows and 60 bulls raised in the stations with the mating ratio of 20-25 cows to one bull by natural mating. The herd is divided to allow for three breeding timeframe categories to provide three lots of weaners per year in different periods due to the limitation of facilities. However, the number of animals recorded at each age group (birth, 200 days, 400 days and two year weight) dropped dramatically (Table 1) and the result from the data shows the undesirable low improvements which are partly due to the unselected animals sold after weaning with a perception that a weaning weight is enough for selection.

Table 1. General data of swamp buffalo in the analysis (record from 1981-1999).

Traits*	Bulls		Heifers		Total
	No. of rec.	Avg. wt.	No. of rec.	Avg. wt.	records
Birth wt.	3 767	29.9	3 866	27.6	7 633
200-day wt.	2 588	147.6	3 370	146.5	5 958
400-day wt.	728	211.6	660	199.8	1 388
2year wt.	578	334.6	484	327.4	1 062

* weight unit in kg.

Recording was made from every animal born on the research station for growth and fertility purposes. Growth traits are weighed at birth, weaning (around 240 days old) and all animals in every herd, every four months after that. Scrotal circumference was recently assigned for measuring from bull calves since they are weaned to identify a bull's own fertility and is genetically correlated with the fertility of his female relatives. Days to calving is measured also for cow fertility which is suited to natural mating under paddock conditions. The most fertile cows calf early, the least fertile cows calf late or not at all.

It is the combined work between the Government research farm and the Buffalo Research Group at the Department. Every research station has the same management system such as register and identification system, recording system, etc. The feeding regime is the decision of the station depending on the cost. Breeding and selection has been made through the performance test programme together with the genetic evaluation results which were decided by the animal scientist from the Department.

When the calf is born it is registered at the Department. Weight, body length, heart girth and height is weighed and measured within 24 hours after birth. The eartag system is used to identify the animal within a week.

The calf is allowed to be with its mother until weaned or about seven to eight months old. The animals will have their own pedigree papers with the data recording details. Cows and calves are weighed every two month. After the calves are weaned, they are selected according to their pre-weaning growth. From each weaning group, 60 top weight males are selected by the committee based on their 240 day adjusted weights, heights, average daily gains, appearance and conformation.

The general management of the performance test programme is implemented under the Government budget. The pre-selected animals are brought to the Central Test Station and are raised in the same management group for one year. They are given 15 percent protein supplemented feed for 1.5 kg per head with mineral block, *ad lib* hay and water. Weight, heart girth, height and body length were recorded monthly. Obviously before 1997, there was no formal index for these various traits and selection was by consensus amongst the committee. At the end of the test, average daily gain (ADG) and two year adjusted weights of the animals were calculated at the central station. The animals were ranked and selected based on two-year adjusted weight and appearances once again by the committee. The very first top ranking bulls are assigned for artificial insemination purposes. This AI practice is a service to farmers free-of-charge according to Government policy. The following ranked bulls are assigned for replacement bulls back to the breeding herds. The animals with average daily gain under 450 g were culled and sold for meat. It can be concluded that there is no breeding evaluation such as the animal EBVs or selection index weight to help make decisions. The young bulls cannot be compared with the older bulls by their individual performances so that the old bulls are kept in the herd to continually reproduce the offspring resulting in long generation intervals, thus, no genetic trend over years of recording. Since 1998 genetic evaluation has been made and selection is based on the genetic merit of the animals. Past data plus the present data are recorded using a software named Herd Magic which every research station has installed in their personal computers. Data are transferred monthly on to the database system at the central office where the mini computers are set up. The Estimated Breeding Values (EBVs) have been calculated from raw data input to the pedigree and performance database of buffalo herds of the Department. These results have been used as the tool for selection ever since.

Even though there are many difficulties for the practical recording operations at village level, such as difficulties for identification of the animals, disappearance of the animals, lack of weighing equipment, uncertainty in age determination, for increasing productivity and income for small farmers, on-farm recording under small farmers is now carried out with the unique objective of genetic improvement. Recently, the Government approached the projects such as “Cattle-Buffalo Bank Royal Project”, “Development of Livestock Production at Small-farmer Level” and “Genetic Dissemination by the Open Nucleus Breeding Scheme”, to

help farmers to raise more buffaloes and not to sell active female buffaloes to the abattoir. Farmers who join the projects are requested to record pedigree, date of birth and identification of the dam and if the sire is known. Weight is estimated through the correlation with heart girth and height of the animals. Those projects have received supplementary budget to help to establish smallholder farms, particularly in the areas where there is an emerging problem with rice and crop production.

On-going genetic improvement programme

The Department of Livestock Development has been collecting data on various aspects of the growth and fertility of buffalo run on its seven (7) livestock research and breeding stations over the decades. The DLD has been collecting data on various aspects of the growth and fertility of beef cattle and buffalo run in its research and breeding centres. This is potentially one of the most comprehensive sets of performance records on beef cattle and buffalo bred in a tropical environment. Previously, most of the information was held in standard format on paper. There is an urgent need to incorporate it into a national computerised database where it can be used effectively to undertake the research which will provide the necessary genetic parameters for use in genetic evaluation and improvement programmes for buffalo and cattle in Thailand. Thus, in 1996 the Australian Centre for International Agricultural Research (ACIAR) supported the five year project "Genetic Improvement of Thai Beef Cattle and Buffalo" (PS1/9311) to assist the Department to set up a system of genetic evaluation, which used the theory of a multi-trait, animal model Best Linear Unbiased Prediction (BLUP) analysis to calculate Estimated Breeding Values (EBVs). This was one of the first national genetic evaluation schemes to use a multi-trait, animal model BLUP analysis.

There are buffaloes that were officially recognised as being of higher genetic value in the sire and dam summary which reports twice a year. To be eligible for the report, sires and dams in the listing have performance recorded progeny born in the last four years and have an accuracy of at least 60 percent for one of the traits.

Data recorded from 1981 to 1999 were entered into the database system all of which were the progeny recorded from 431 sires and 3 198 dams. The 1999 sire and dam summary reports EBVs for 79 registered sires and over 1 000 dams for up to five growth traits. The young sires as well as all heifer calves are reported similarly to the sire reports but these include information only on classified calves at two years of age who have at least two post-birth performance observations.

The GROUP BREEDPLAN software estimates the breeding values (EBVs) from which the analysis is based on the use of a multi-trait, animal model Best Linear Unbiased Prediction (BLUP) analysis for individual buffalo for seven traits which are birth weight, weight at 200 day milk, 400 day, 600 day, cow mature weight, scrotal circumference and day to calving. At

present, five growth traits are analysed. The fertility traits which need more data to make the results reliable will soon be analysed. EBVs of sires and dams all existing in DLD herds are published as the sire and dam summary annual report. The report also presents a listing of genetic merit for young bull and heifer buffaloes.

The software GROUP BREEDPLAN V 4.1 is developed by the Animal Genetics and Breeding Unit, University of New England, Australia. It produces across-herd EBVs (Graser *et al*., 1987) and uses an implicit animal model and sparse matrix absorption to reduce computing costs (Tier and Graser 1991). Restricted Maximum Likelihood (REML, Meyer, 1993) procedures have been developed and used to estimate the necessary genetic parameters used in the analysis. EBVs for weights (birth to 600-day) and fertility traits have been analysed to rank the breeding buffaloes for selection. The fertility traits are scrotal circumference in bulls and the number of days from exposure to the bull to calving in cows (days to calving).

The organization responsible for the genetic evaluation of buffalo in Thailand is the Animal Husbandry Division, Department of Livestock Development. The development of breeding improvement programme can be divided into two phases.

Previously, selection was based on the performance test programme which was part of the National Buffalo Research and Development Project. This project operated under the guidance and supervision of the Research Implementing Committee who were the researchers from DLD and cooperating agencies. The performance test programme was conducted by a group of the Committee appointed from DLD and representatives from universities. Buffaloes from every test were judged and ranked based on their growth rate during the test and appearances.

Presently, the project involves research staff from the Agricultural Business Research Institute (ABRI), the University of New England's (UNE) Department of Animal Science, the Animal Genetics and Breeding Unit (AGBU) and the Tropical Beef Centre (TBC) collaborating with the Thai personnel in the DLD who are responsible for beef cattle and buffalo improvement. Since the ACIAR Project was implemented, animals have been genetically evaluated and interpreted by the staff geneticists. It is proposed that a coordination committee be established for the project as follows:

Thai Representatives
Director General, DLD
Director, Animal Husbandry Division, DLD
Director, Planning Division, DLD
Ancharlie Na-Chiangmai, Buffalo Research Group, as Project Leader

Australian Representatives
Mr P.A. Rickards, Managing Director, ABRI
Dr J. Vercoe / Mr J. Croaker, Alternative Delegates, TBC

Dr J. Copland, ACIAR
Dr H.U. Graser, Director, AGBU

The working staff consists of a computer system manager who is literate in computer systems with some software development experience and responsible for the central computer system and for coordinating the training of staff at the Research and Breeding Centres in use of personal computers for data capture; a PC expert/trainer appointed to the project for data collection, the transfer of data to the central computer and the use of word processing and other relevant PC software; and two data entry staff entering the past records to establish the central database. For research on genetic and breeding of buffalo, work has been undertaken by animal scientists supervised by the chief of the buffalo research group at the Department. Personnel in the research and breeding centres are given on-site training on how to capture their past records on PCs using software customised for the project. With this organization it is possible to achieve effective communication from the breeding stations to the central processing facility in Bangkok and then from the central processing facility to the Coordination Committee via the Project Leader.

The Department of Livestock Development through the Buffalo Research Group, Animal Husbandry Division now has 1 200 breeding dams being raised at its research stations. It has been planned to increase the number by at least 500 merit offspring per year according to the genetic dissemination by the Open Nucleus Breeding Scheme. Not only this implementation but also the buffalo research in various aspects is strongly recommended. Obviously, buffalo in Thailand is now classified as the native animal to be urgently researched under the genetic diversity and conservation aspects therefore the elite animals will be used as the source material in this regard. A genetic improvement programme has been set up as the DLD policy. The achievements of the programme are listed below.

Elite herd establishment and genetic distribution

It is aimed at increasing the growth rate and fertility of these animals which makes them more profitable meat producers. Therefore, the buffalo elite herds are set up at two research stations. Selection of the merit animals through their EBVs for traits of interest is made from the result of BREEDPLAN analysis. Those buffaloes with high index EBV will be selected for replacement in the original herd for breeding improvement. The rest of them will be used in the multiplying herds and to the farmers. The excess sires and dams will be used in the multiplying herds at other Government stations as well as at the contracted farmers as the Government-farmer joint project (on-farm trial).

The genetic improvement programme at small farmer level

This programme is set up according to DLD priority. The farmers who join the programme have to sign a contract with the acceptance of the conditions made by the Department. The members have to record basic data while the officers will give advice and regularly investigate results. It is expected that about 400 000 buffalo cows in the country will be stable with efficient production.

Research and development on livestock biotechnology and genetic conservation

Researchers from DLD, as the network coordinator and various universities and institutions will be encouraged to jointly research and develop the buffalo production technology in various branches as follows:

a. Biotechnology research to increase efficiency in breeding distribution of the breeding-improved buffaloes as:
   - DNA finger print to identify livestock genetic merit which will bring about sustainable utilisation;
   - database system and bioinformatics for management of livestock genetic resources and related resources.
b. Technology research and development study for increased production for consumption such as:
   - fattening potential of swamp buffalo for meat consumption;
   - raising methods in various forms.

The computerised database is now being used effectively to undertake the research which will provide the necessary genetic parameters for use in genetic evaluation and improvement programmes for buffalo and cattle in Thailand. Results from GROUP BREEDPLAN analysis showed that there was a deficiency of linkage (sires in common) across all DLD stations. There was only a linkage between six herds out of 24. To make data the most useful in the analysis, linked sire either natural mating or artificial insemination is recommended. Results also show that there is no genetic trend over years of recording. This is probably not a good implication because the selection depends only on the phenotypes. It also shows little variation among the sires used because many of the sires used do not have daughters being used as replacements in the herds, thus the undesirable low genetic progress. Accordingly, the small population of the young animals was selected as the replacement made to the standardised selection differential of selected buffaloes was quite small. In addition, the buffaloes selected at two years of age were practically raised in the replacement herd until they were three to four years old. In the mean time, the old animals continued being used in the breeding herd. Another factor affecting the progress is that selected animals were not used as a replacement in the herds from where they came. Therefore, better animals not used in the herds thus delay the progress. As a result, the average generation interval of sires and dams was rather high, giving less genetic gain per year. It was concluded that the previous breeding plan needed to be developed to accelerate response of selection. The present system of sire selection from small Government herds is unsatisfactory, so

that the field recording of performance data and their utilisation alone or along with the farm data should be attempted to increase genetic gain through selection and movement of genetic material. The reproductive efficiency of the buffalo cow remains low and unchanged which limits the consistency of the annual genetic gain.