Agronomy Research **16**(2), 564–573, 2018
https://doi.org/10.15159/AR.18.065

Implementation of practical solutions to improve buffalo breeding development in rural areas of South Iraq

G. Rossi[1], L. Conti[1], K. Al-Fartosi[2] and M. Barbari[1,*]

[1]University of Firenze, Department of Agricultural, Food and Forestry Systems (GESAAF), Via San Bonaventura 13, IT50145 Firenze, Italy
[2]Dhi-Qar University, College of Science, University Campus, IQ0096442 Nassiriyah, Iraq
[*]Correspondence: matteo.barbari@unifi.it

Abstract. Buffalo breeding is widely spread in rural areas of southern Iraq, especially in marshlands. In the Provinces of Basrah, Dhi Qar and Maysan the buffalo represents the main source for survival of local people in marshlands. The paper shows the situation in these areas, remarking the main critical points for buffalo breeding development. A survey in 24 buffalo farms was carried out by the Department of University of Firenze to verify the situation of buffalo farming in southern Iraq (years 2014–2016). In particular the study shows problems related to the shortage of food for animals, to the lack of suitable structures and infrastructures, to the poor herd management by farmers. In the paper the main critical points, which compromise the success of the breeding, are pointed out, with particular reference to animal welfare, animal health and labour (care of animals and risks for workers). Solutions to mitigate the scarce results are indicated. In particular some practical interventions carried out during a project funded by Italian Agency for Cooperation and Development are presented and discussed. Such interventions refer mainly to the application of feeding racks, systems for a safe capture of the animals, plants and equipment for heat protection. As conclusion, also in difficult and poor areas like Iraqi marshes, a correct design and a right application of simple constructive and plant solutions, with little employment of technological resources, coupled with a good training of farmers, can give a contribution to solve problems in buffalo breeding.

Key words: buffalo, livestock housing, marshlands, Iraq.

INTRODUCTION

The marshlands in southern of Iraq historically comprised the largest wetland ecosystem of Western Eurasia. The Mesopotamian marshes of southern Iraq (30° to 33° N, 45° to 48° E) are considered the 'cradle of western civilization' and are often referred as the 'Garden of Eden'.

Livelihood of inhabitants of marshes, the marsh Arabs or Ma'adan which are the descendants of ancient Sumerians, is entirely dependent, with a symbiotic relationship, on domestic Asian water buffalo (*Bubalus bubalis*) (Al-Saedy & Al-Fartosi, 2013). The buffalos provide to people dairy products, meat, skin, dung for fuel, and labour. There is no house in the marshes area without buffalos (Al-Saedy & Al-Fartosi, 2011).

Buffalos have high capacity to face adverse environmental conditions and a remarkable longevity (up to 10 years production period) (Pawar et al., 2012). The ideal habitats for water buffalo are floodplain environments with a mixture of abundant grasses and available water bodies (Petty et al., 2007). Access to water is important also for thermoregulation of buffalos which go to the marshes in the hot season to cool their body temperature (Fazaa, 2007). The water buffalo feeds on common reeds by grazing as well as on reeds cut by the farmers. Buffalos can be also fed with protein-rich concentrated food when available (Abid & Fazaa, 2007).

Many factors led to decline of buffalo population, such as the Gulf wars, the economic blockade, the removal of subsidies on feed for farmers (FAO, 2005; Al-Saedy, 2007). However, the systematic marsh drainage can be considered the main cause for the reduction of buffalo population. During the period of 1991–2003, wide areas of reed beds and lakes of southern Iraqi marshes were ditched and drained by the previous Iraqi regime for political reasons. Marsh desiccation was an environmental disaster that severely affected the wildlife of southern Iraq (Richardson & Hussain, 2006).

The number of buffalos decreased from 141,450 heads in 1986 to 98,700 heads in 1993 (Ligda, 1996). Another study reported that in the early 1990s total buffalo population in Iraq was about 200,000, but by 2003 it dropped to 130,000 heads, with a 35% decrease (Al-Marsomy, 2005).

The re-flooding of the marshland areas after the second Gulf war of 2003 allowed to many breeders to return to the marshes and buffalo breeding resumed developing. Buffalo population increased in the study area after re-flooding, reaching numbers higher than after desiccation and potentially close to the numbers recorded before desiccation.

In 2007 a report on Maysan and Dhi Qar Provinces showed a steady increase in the number of buffalos, estimated in 40,008 head. About 83% were female, and approximately 72% of these females were more than two years old, the age of fertility and milk productivity (Abid & Fazaa, 2007).

Al-Saedy & Al-Fartosi (2013), reporting data from Ministry of Agriculture Census (2008) about water buffalos distribution in Iraq, indicated a total number of 285,537. In Southern Mesopotamian marshes about 45% of buffalos of the entire Iraq were concentrated, and in Dhi Qar Province 49,283 heads (29,270 female) were counted.

The management pattern of buffalo herd is based on small holders, which own between 5 and 50 head. Only few herds can arrive to more than 150 head.

The main objective of buffalo breeding is the production of dairy products, in particular fresh milk and thick cream. Males, used to produce meat, are slaughtered after weaning.

The performance of adult buffalo female is considered in the range of 3–7 litres of milk per day, with 7–8% of fat. Lactation lasts 250 days on average (Al-Saedy & Al-Fartosi, 2011). The highest milk production is reached when the cow can be fed with concentrated high protein food, but even in the best cases, the amount of milk produced per cow is still low (Abid & Fazaa, 2007). Such relatively low milk yield cannot be attributed definitely to the genetic potential of the Iraqi buffalo, since much of the genetic potential is not fully performed for several environmental influences, such as inadequate nutrition and poor management (Speedy & Sansoucy, 1989). Milk production can be much higher, reaching up to 12 litres/cow per day, when good nutrition is available on a constant basis (Abid & Fazaa, 2007). Researchers underline also the importance of veterinary services, which have to be improved (Tabeekh et al., 2017b).

About the restored wetlands, they need to be hydraulically designed to allow sufficient flow of non-contaminated water and flushing of salts through the ecosystems (Richardson et al., 2005).

The potential for developing new economic opportunities based on water buffalo husbandry could have a great impact on marshland communities. The local population needs assistance in developing this potential in a variety of ways. Tabeekh et al. (2017b) suggest to improve housing conditions of the animals and to provide good nutrition with government-supported feedstuffs, as well as to improve the living conditions of the farmers (drinking water plants, supply electricity to the villages, realization of schools, health clinics and veterinary clinics).

A cooperative, multi-disciplinary approach is needed to achieve such a goal and additional studies will be required to support better planning (Tabeekh et al., 2017a).

The present study aims at assessing the situation of buffalo farms, pointing out the main critical points, in order to propose simple solutions to improve the management and, consequently, obtain better performance, taking into account animal welfare and health conditions of the animals, and safety of the workers.

MATERIALS AND METHODS

A survey on 24 buffalo farms was carried out in 2014–2016 in marshes area. The buffalo farms were located in Dhi Qar Province, in the area between the villages of Suk-Al-Suyuyk and Al-Chubaish (30°48' to 31°01' N, 46°49' to 47°08' E), as represented in Fig. 1. The survey was conducted by researchers of University of Firenze, guided by colleagues of Dhi Qar University.

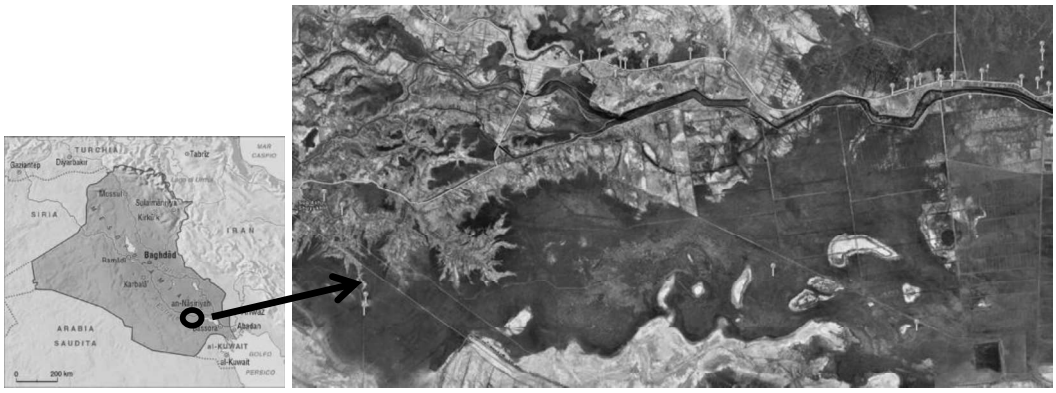

Figure 1. Position of buffalo farms examined during the survey in marshlands area (Dhi Qar Province).

A questionnaire containing different items focused on buffalo farming was fulfilled during the visits of the farms. The questionnaire collected information by local buffalo breeders concerning housing solutions, plant and equipment for feeding, plant and equipment for heat protection, milking systems, manure management, milk storing and processing. Information on food, health problems and management of the herd were also collected.

The farms were divided first of all into two groups, 12 intensive farms and 12 extensive farms. This classification is mainly based on the kind of keeping of the animals.

In intensive farms the buffalos are housed in a barn (closed or open), tied or free in pens with fences. The farms with animals tied by neck belt collar or leg chain are indicated as a); the farms with animals free within fences/walls are indicated as b). In both these cases the feed is brought to the animals by a worker and distributed on the ground or inside a trough or a sack, but, generally, functional areas are not specifically provided.

In extensive farms the buffalos are free to move outdoor during the day, generally in marshlands, and to get food during grazing. This kind of farms is indicated as c). The animals come back to the village for the night and kept close to the house of the farmer without specific structures.

The survey, carried out in the farms, aimed at finding critical points for the breeding of buffalos. The main critical points were divided into four groups: 1) animal welfare; 2) animal health; 3) labour; 4) farm management. Taking into account the main critical points for the two kinds of breeding, solutions to improve the management of the herd were identified and proposed.

RESULTS AND DISCUSSION

Due to the lack in data collection by the institutions present on the territory and the poor propensity of farmers to provide information, it was impossible to acquire exact information on the number of heads in the farms. The number of female buffalos per farm is included between 20 to 150 cows, with an average number of cows per farm around 50. The daily milk yield per cow is about 5 l, but the right amount is not collected in an official way, also because the milk is often used once a day to feed the calves. For the exposed reasons the performance of the herds was not evaluated during the survey.

Table 1 summarizes the main critical points related to the different keeping systems of the buffalos. The information are divided into three groups, in relation to the keeping system: a) animals kept in a barn, tied by neck collar or leg chain; b) animals kept free in a barn within fences or walls; c) animals free to go outdoor during the day. This last situation is referred to buffalos going to the marshlands for grazing during the day.

a) Animals kept in a barn - Tied by neck belt collar or leg chain

The animals tied in the barn have problems related to poor animal welfare conditions. The buffalos are blocked in the same place during the day and cannot walk. This situation hampers a functional exercise and forces the animals to be subjected to the thermal environment of the barn. These conditions can have negative effects on productive and reproductive life of buffalos.

The constraint of the animals has negative repercussions also on animal health. Body condition is influenced by the scarce physical exercise. Furthermore the system to tie the animals can cause body lesions to the neck or the legs. Another aspect remarked during the visits concern the state of claws, feet and legs. In particular animals do not consume the claws, causing negative effects on the health of the feet and legs. This situation was found in all the farms included in the survey. Furthermore it has to be remarked that regular interventions by farrier are not provided.

Table 1. Main critical points related to different keeping systems of buffalos

Animal welfare	Animal health	Labour	Farm management
a) Animals kept in a barn - Tied by neck belt or leg chain			
			
- Functional exercise - Thermal comfort	- Body condition - Body lesions - Claws, feet, legs - Hygienic conditions during milking	- Care of animals *(cleaning, feeding, milking)*	- Collection of data *(individual head)*
b) Animals kept in a barn – Free within fences/walls			
			
- Design of the barn *(not suitable areas)* - Thermal comfort	- Competition among animals - Hygienic conditions during milking	- Lack of rational solutions *(cleaning, feeding, milking)* - Risks for workers - Capture systems	- Collection of data *(individual head)*
c) Animals free to go outdoor during the day			
			
- Control of animals	- Control of animals - Competition among animals - Hygienic conditions during milking	- Lack of rational solutions *(cleaning, feeding, milking)* - Risks for workers - Unavailable capture systems	- Collection of data *(individual head)*

Also the labour is negatively influenced by this kind of housing for several reasons. The care of animals requires time because each animal has to be managed individually: the feed has to be brought directly to the single animals, the milking has to be made by hand moving from head to head, the cleaning has to be made in each place. For these

reasons the amount of labour is higher than in other keeping systems, and the quality of work is worse, mainly due to the uncomfortable position of the workers during the milking.

One of problems underlined during the survey concerns the absence of milk plants to receive farmers' milk that leads to loss of the products especially in hot season.

b) Animals kept in a barn – Free within fences/walls

Concerning the welfare of buffalos kept in an area within fences, problems have to be remarked related to the poor design of the barn. The functional needs of the animals are not kept into account, as the absence of functional areas proves. Usually mangers are included in the resting area without a specific feeding alley. Furthermore no specific solutions for heat protection are applied in the barn. This situation is common for the totality of the farms.

Also animal health can be compromised by the poor housing solutions adopted in the farms. For example, a specific feeding area is not realized, and for this reason competition among the animals of the group is particularly strong during feed distribution.

The lack of acceptable hygienic conditions during milking, mainly due to the absence of a specific milking area, cause problems of quality of the milk and produce risks for the health of people consuming the dairy products.

About the labour in this kind of farms, the lack of rational housing solutions gives problems in terms both of amount and of quality: no manure evacuation systems are adopted; feed has to be brought directly to the animals in a high trough; milking has to be made inside the fence without specific areas designed. These conditions cause an increase in times of work, and, for the uncomfortable positions of the workers, a worsening in quality of labour. The total absence of systems for the capture of the animals compromises the safety of the men (farmers, technicians, veterinarians), which work in conditions of serious risks.

c) Animals free to go outdoor during the day

In these extensive farms the buffalos, which are free to move outdoor during the day, have to be checked at the return to barn or fence in the evening. From the animal welfare point of view, it is required an accurate daily check of all the animals when they come back from the marshlands, in order to assess the health conditions.

Competition among the heads of the herd can be relevant at the moment of collection in the barn or in the fence for feeding.

A specific milking area is never realized and the buffaloes are milked by hand in the same way of ones kept tied, causing the same problems.

About labour, the absence of rational solutions gives problems both in terms of amount and of quality. Feeding and milking are important working activities that in extensive farms are executed without specific safety procedures. Furthermore the risks for the workers are notable due to movements of the animals coming back to the barn. Also in this case capture systems of animals are unavailable in all the farms of the survey.

On the basis of the results of the survey, taking into account the main problems summarized in Table 2, solutions to improve the management of the herd were studied and proposed. The proposed solutions have to be suitable for the farmers living in poor conditions in the marshlands, where lacks in the supply of means of production

(including the electricity) represent the reality. The main objective taken into consideration defining the solutions for the farmers is to favour the management both for the welfare of animals and for the safety of farm workers. The solutions have to assure easy interventions on the animals, minimizing stress conditions. Furthermore it is necessary to guarantee the control of all the heads, including animals living far from the villages.

Table 2. Main mistakes found in the 24 buffalo farms of survey

Feeding	Feeding alley enough wide, but manger with high border
	Rack too thin, not suitable for cows or buffalos
	Rack does not allow to capture animals
	Flooring of cows higher than the bottom of the manger
	Kerb too wide and cutting
	Manger with high border, not accessible from outside
	Spaces for single animals not well calculated
	Manger without rack, allowing animals to go inside
	Manger too narrow, with high border, not accessible from outside (problems of feed wastes)
	Feed distribution without any control of feed intake by single animals
Drinking	Water distributed in tanks too big
	Water not continuously renewed
	Water distributed in a unusual water tank (e.g. a boat)
Heat protection	Barn too low for hot climate areas
	Shading area too small to cover all the heads
	Materials for covering not suitable (metallic sheets)
Milking	No specific milking areas
	Buffalos milked without the respect of hygienic rules
	Specific areas for milk processing not available
Manure collection	Manure not collected, remaining inside the barn/fence
	Floor wet, not hygienic
	Developing of flies for poor conditions
Calves	Situations with young animals not kept in an appropriate way
Safety-health of workers	Relevant risks for safety and health of workers (biological risks, chemical risks)
	Loads handling (materials, animals, equipment, etc.)
Information system	No collection of data on single head, no specific management procedures for the herd

Another important need is related to the safety of the workers. For this reason solutions to capture the animals are proposed, based on fences or racks. The first solution is given by a system of fences (corral) able to block a single animal in a cage. The second solution is constituted by the self-capturing racks placed in a specific feeding alley. The realization of well-designed functional area can improve the comfort of the animals and simplify the labour of the farmers.

For milking, in relation to the low number of heads to milk each day and to the uncertainty of availability of electricity, a specific milking parlour is not suggested. The simple intervention, suitable also for marshlands area, is based on the realization of two stalls provided with a self-capturing rack to guarantee the safety of workers, concrete

floor to drain urines and cleaning water, and a cooling system to create a comfortable area both for animals and for men. Fig. 1 shows the main interventions designed for the farms located in marshlands area and realized in some pilot farms to train the farmers involved in the project. Fig. 2 reports the two solutions proposed and realized to improve the safety of the workers.

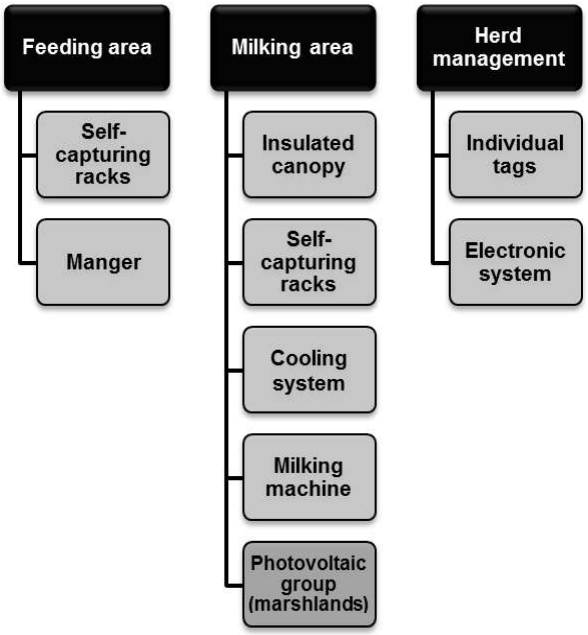

Figure 1. Main interventions proposed to the farmers and realized in some pilot farms to carry out FFS program.

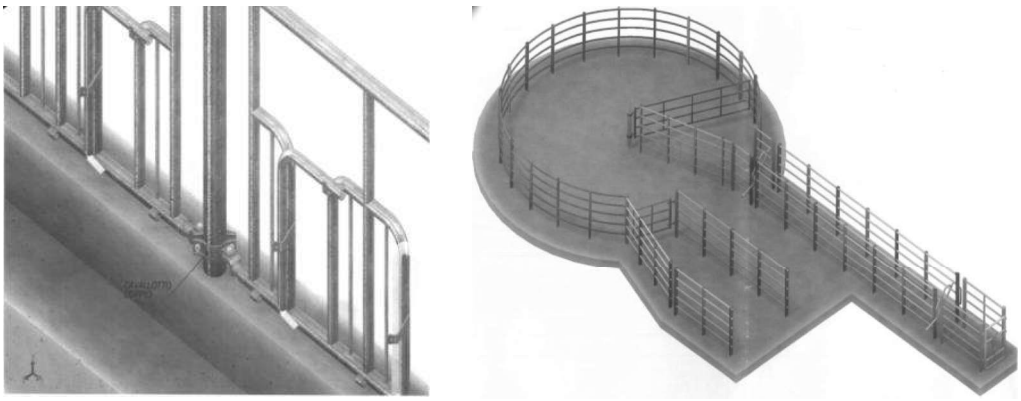

Figure 2. Proposed interventions for capturing of the buffalos: a self-capturing rack (left); a corral (right).

The selected pilot farms were used as Farmer Field Schools (FFS). Therefore an intensive program of training was carried out in these farms to involve a large number of persons: farmers with the whole family, technicians, and veterinarians.

Fig. 3 shows some phases of activities: realization of a self-capturing rack in the Training Centre of Dhi Qar University (a); training concerning the use of mobile photovoltaic panels provided for farms of marshlands (b); training of the farmers living in marshlands area (c). It is important to remark that this last activity of training was carried out by local technicians trained during the main course kept by the staff of University of Firenze. The training in FFS involved about 600 persons.

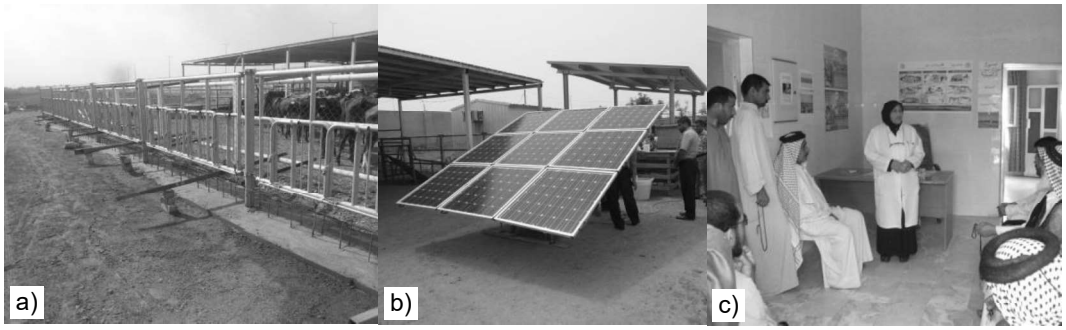

Figure 3. Examples of activities in the FFS: a self-capturing rack (a); photovoltaic panels (b); training of farmers of marshlands (c).

CONCLUSIONS

As main conclusion, a correct design and a right application of simple constructive and plant solutions, with little employment of technological resources, coupled with a good training of farmers, can give a contribution to solve problems in buffalo breeding also in difficult and poor areas like Iraqi marshes. The solutions have to be applied taking into account the different requirements of the animals which can be kept in intensive or extensive system, and, at the same time, the need to create safety conditions for the workers.

A strong and long-term work is required to improve the buffalo sector in the marshlands area of South Iraq. The activities carried out during the project represent a first step in the development of livestock production. The information brought by the staff of University of Firenze in collaboration with Dhi Qar University has reached a high number of farmers in the villages of the marshlands. This goal was reached thanks to the involvement of several technicians of the various institutions of the Province, which carried out the following important phase of training of farmers based on the pilot interventions realized in the Farmer Field Schools.

To obtain a significant improvement in the productivity and to favour the development of a suitable chain linked to buffalo breeding, in the next years the services provided to the farmers have to be enhanced. The farmers of the small communities distributed along the southern marshes demonstrated to appreciate the assistance given by skilled technicians and are open to the introduction of innovations in the farm management.

Urgent priorities for Iraqi buffalo breeders are related to the provision of suitable foods for the animals, in particular concentrated feed, to the processing of the dairy products in healthy conditions, to the valorisation of dairy products on the market.

The next step that could be carried out in a further project is the realization of modern infrastructures, mainly dairy factories, in carefully selected areas. A cooperative approach, directly involving all the components of the dairy chain, is needed to achieve such a goal.

ACKNOWLEDGEMENTS. Project funded by Italian Agency for Cooperation and Development (AICS). The authors express gratitude to local people taking apart to the activities of the project, to Dhi Qar Governorate and Dhi Qar Agriculture Directorate, and to all the other Iraqi Institutions involved in the project. A particular thank is addressed to Mr. Imad Ali Hayif for the important support given during all the phases of the project.

REFERENCES

Abid, H.S. & Fazaa, N.A. 2007. *Water Buffalo in the Iraqi Marshes*. Thi Qar and Missan Governorates. Nature Iraq Status Report, 29 pp.

Al-Marsomy, J. 2005. *The Marshes: Neglected Economic Fortunes*. The Iraqi Society for marsh. Restoration and Development, 15 pp.

Al-Saedy, J.K. 2007. Iraqi buffalo now. Proceedings 8th World Buffalo Congress. *Italian Journal of Animal Science* **6**, 1234–1236.

Al-Saedy, J.K. & Al-Fartosi, K. 2011. Iraqi buffalo status and perspectives. *Buffalo Newsletter* **26**, 17–19.

Al-Saedy, J.K. & Al-Fartosi, K. 2013. Mesopotamian buffaloes (the origin). *Buffalo Newsletter* **28**, 25–30.

FAO. 2005. *http://www.fao.org/faostat/en.* Accessed 15.1.2015.

Fazaa, N.A. 2007. Interim Draft Report on Water Buffalo in Chubayish, 15 pp.

Ligda, D.J. 1996. The water buffalo population and production in Iraq. Cited by Nature Iraq Status Report 2007. http://www.natureiraq.org/literature.html. Accessed 02/10/2017.

Pawar, HN, Ravi Kumar, G.V.P.P.S. & Raman, N. 2012. Effect of Year, Season and Parity on Milk Production Traits. *Journal of Buffalo Science* **1**, 122–125.

Petty, A.M., Werner, P.A., Lehmann, C.E.R., Riley, J.E., Banfai, D.S. & Elliott, L.P. 2007. Savanna responses to feral buffalo in Kakadu National Park, Australia. *Ecological Monographs* **77**(3), 441–463.

Richardson, C.J., Reiss, P., Hussain, N.A., Alwash, A.J. & Pool, D.J. 2005. The restoration potential of the Mesopotamian marshes of Iraq. *Science* **307**, 1307–1311.

Richardson, C.J. & Hussain, N.A. 2006. Restoring the Garden of Eden: an ecological assessment of the marshes of Iraq. *Bioscience* **56**(6), 477–489.

Speedy, A. & Sansoucy, R. 1989. *Feeding dairy cows in the tropics*. Proceedings of the FAO Expert Consultation, Bangkok, Thailand, July 7–11, 244 pp.

Tabeekh, M.A.S.A., Mohsen, H.A.M.A. & Al Jaberi, A. 2017a. The reality of buffalo breeding in Basra Governorate. *Journal of Buffalo Science* **6**, 8–18.

Tabeekh, M.A.S.A., Maktoof, A.R. & Mohsen, H.A.M.A. 2017b. Solutions or alternatives to protect livestock, especially buffalo from the risk of drought in Basra Governorate. *Canadian Journal of Agriculture and Crops* **2**, 84–89.