

The Water Buffalo: Domestic Animal of the Future

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Summary

The water buffalo (*Bubalus bubalis*) is a neglected bovine animal with a notable and so far unexploited potential, especially for meat and milk production. World buffalo stocks, which at present total 150 million in some 40 countries, are increasing steadily.

It is important that national stocks should be upgraded by selective breeding allied to improved management and nutrition but, from the standpoint of increased production and the full realization of potential, it is equally important that crossbreeding should be carried out extensively especially in association with schemes to increase and improve buffalo meat production.

Meat from buffaloes which are reared and fed for early slaughter is of excellent quality. Because the buffalo is a superb converter, meat can be produced at lower cost than with cattle and without the need for expensive fodders and concentrates.

There is growing interest, in both the advanced and the developing countries, in the full exploitation of the domestic water buffalo, as is shown by the expanding international trade in breeding stock and the establishment of many new herds in countries where the buffalo is a newcomer. The upsurge of international interest and activity is not yet shared by the United States, though the future for this attractive, tractable, and productive animal is one of undoubted and outstanding promise.

Introduction

The water buffalo, *Bubalus bubalis*, is one of the world's most neglected domestic animals, and the one with the greatest unexploited potential.

A major reason for neglect is that the buffalo exists in greatest numbers in those countries, mostly in the East, which are referred to, sometimes euphemistically, as the developing countries. Until relatively recently there have been few if any facilities for research and little incentive to improve existing conditions.

The animal commonly referred to in Northern America as the buffalo is not, properly speaking, a buffalo at all but a bison, a distant cousin bearing roughly the same tribal relationship to the true Asian buffalo as does the sheep to the goat or the yak to the ox. The bison can be crossed with cattle

to produce the cattalo, or beefalo, a heavy meat-type animal for which widely publicized claims have been made. The water buffalo has never been shown to produce offspring either fertile or sterile when mated with cattle, although under suitable conditions a bull will serve female buffaloes, while a male buffalo will mount cows.

There are about 150 million water buffaloes in the world compared to a cattle population of around 1,165 million. This is a significant figure, especially when it is considered that the majority of buffaloes are productive in terms of milk, work and meat, or any two of these outputs, whereas a high proportion of the world's cattle is economically useless.

In the majority of buffalo-owning countries, and in all those in which buffaloes make an important contribution to the agricultural economy, numbers are increasing, sometimes at quite phenomenal rates. In some extensive areas buffaloes present a substantial challenge to cattle. In India, for example, which has the world's largest buffalo population (at least 60 million) the buffalo now supplies almost 70 percent of all the milk used for human consumption. The picture is similar in Pakistan where there are several outstanding milk breeds in a population of around 14 million. China, which has the second-largest establishment with over 30 million, utilizes her buffaloes almost exclusively as work animals and, until very recently, has failed to realize any of the outstanding potential for milk and meat. There are indications now in the People's Republic that her dynamic progress in agriculture will be extended to the fuller exploitation of her domestic animals, among which the buffalo is one of the more important (Cockrill, 1976).

The awakening awareness of the true value of the water buffalo is shown by the following list of selected countries and populations (in thousands), in all of which the national population is increasing and is receiving official attention and support:

Country	Average population	
	1961-65 (FAO Production Yearbook)	1977 (Author's estimate)
USSR	385	520
Bangladesh	505	800
Burma	1,117	1,900
Iraq	238	340
Nepal	3,067	3,900
Philippines	3,357	5,050
Egypt	1,559	2,800

A number of countries in Latin America, including Colombia and Venezuela, have recently introduced nucleus breeding stocks from Australia, Trinidad and Italy. These are thriving well, as are new populations in Bolivia, Costa Rica, Nigeria, Mozambique and Papua New Guinea.

Buffaloes were introduced into Brazil at the turn of the century and there have been numerous importations since then. There are now some five distinct breeds in the country and a flourishing population of over a quarter of a million. In the Amazon Valley the buffalo has adapted to its environment in a manner which can only be described as spectacular: the high fertility rate, early maturing, and outstanding meat production capacity would indicate that within the next three decades the buffalo will largely replace cattle. Given import facilities and sound management, the animal has a bright future almost everywhere in the Americas.

There have been buffaloes in a number of European countries for many centuries. They include Greece, Hungary, Romania and Yugoslavia. Perhaps the most outstanding are Bulgaria and Italy in both of which there are active research programs and the native buffaloes, known as the Mediterranean breed, are thriving and multiplying. Before World War II, Mussolini who, like some other influential but ignorant people in high places, regarded the buffalo as indicative of a primitive and backward agriculture, suppressed buffalo rearing and the population declined to a dangerously low level. With the fall of the Fascist regime the buffalo stocks began to increase and there are now well over 100,000 in Italy, utilized mainly for milk production with meat as an increasingly important sideline. The history of the Italian buffalo dates back 1,000 years, during which time there have been no recorded imports. The Mediterranean buffalo is a stocky, pleasing, high-yielding animal which combines both meat and milk characteristics. Some of the world's most advanced buffalo enterprises are located in the southern half of Italy and the breed is attracting a growing amount of attention by Latin American and African importers (Figure 5).

In much of the developing world the buffalo is primarily a work animal. In the Indian sub-continent it is the supreme milk producer. Meat is a byproduct from labour and milk production but it is now emerging as probably the most important aspect of buffalo productivity for the future.

The Working Buffalo

From time immemorial the buffalo has been the working animal of the world's padi lands, and an integral factor in the production of rice, which is the basic food of one-half of the world's human population. The original habitat was northern India and south China, and there is a history of domestication reaching back to at least 2,500 B.C. They were first domesticated in the great riverine civilizations of the Euphrates and Tigris, the Indus and the Yangtze.

The domestic animals which have the greatest affinity for man are the horse, the dog and the water buffalo. This affinity and their docile temperament facilitated the taming and domestication of buffaloes as is currently being demonstrated in Australia's Northern Territory. Buffaloes were introduced from Timor about a hundred and fifty years ago as a source of meat for the isolated military and administrative stations. Some escaped or were turned loose and a feral population quickly became established. These stocks are now being re-domesticated. Two weeks after being rounded up in the bush and corralled for the first time they can be haltered and handled (Cockrill, 1974).

There are literally millions of domestic animals whose output is measured in terms of work rather than protein. They are mostly cattle, equines, camels and buffaloes, and they are used to plough, harrow and grade the land, to pull carts or drays, as pack animals and for general draft purposes such as raising water from deep wells or providing the power for mills. Their use is extensive through most of the developing world. The tendency to regard such use as indicative of a primitive agriculture needs to be corrected. The work animal is generally economically efficient and is the best available means of carrying out the work to be done, especially for the small farmers who abound in the developing countries. Their value has been considerably increased and emphasised in recent times due to the rise in fuel costs which has hit the developing world particularly hard and has caused some drastic re-thinking in many areas where mechanization had begun to make advances in the agricultural scene. Shortage of manpower is seldom a problem or a stimulus to mechanization in third world countries where the man with his one or two work animals is the vital production unit.

Only in countries where manpower availability is low and oil fuel is cheap, plentiful and readily obtained is there an economic argument for relegating the work animal to history. Although draft animals have virtually disappeared from the western world, elsewhere their numbers are declining only slowly. They will long retain the place they have held in agriculture for the past four or five thousand years (Mason, 1974).

As mechanization advances, however slowly, it is important that the stocks of animals traditionally bred for work, as were the oxen of Europe, should not disappear. These are the nucleus breeding stocks of tomorrow's meat industry and they represent an enormously important genetic potential. Buffaloes have been bred for weight and muscle power, the qualities which must be exploited in the production of meat (Figure 1).

The swamp buffalo is the commonest working breed, but many of the milking breeds are also good work animals. In the East, the hardy, nondescript, mongrel *desi* buffaloes of no recognisable breed are commonly used on the roads as both draft and pack animals.

The Milch Buffalo

Roderick Macgregor (1941) of Malaya, a veterinarian and pioneer buffalo worker, classified the animals as falling into swamp and river groups, and it is convenient to consider all the breeds and types under these two headings.

The swamp buffalo is a breed in its own right. It has an outstanding potential for meat production and is capable, under suitable management, of producing a satisfactory yield of milk. It is widespread throughout southern China, Indochina, Indonesia, Malaysia, Philippines, Thailand and other countries of the Far East.

The river buffaloes include the milking breeds of India and Pakistan and some European countries. Macgregor, commenting on the wallowing proclivities of buffaloes, observed that the swamp types in general prefer a mudhole in which they like to acquire a generous plastering of mud, while the river types tend to favour ponds of slowly flowing water (Figure 2).

All breeds present a picture of complete bliss when immersed in a wallow, whatever may be its nature. They chew the cud with half-closed eyes and utter typical deep sighs of contentment. The wallow and

the mud plaster provide protection against solar radiation and biting insects.

While the buffalo is a remarkably versatile animal it is not adaptable in the physiological sense. It suffers discomfort if subjected to the direct rays of the sun for any length of time or if worked or driven excessively. If exposure is prolonged the distress becomes acute, and prostration and death may follow quickly. Although by nature a semi-aquatic animal, the wallow is not strictly necessary to its well-being. Buffaloes can thrive anywhere provided there is suitable pasture, ample drinking water and sufficient shade to enable them to avoid the heat of the day. In temperate climates exposure to cold winds, drafts and chill rain also induces stress.

By far the greater number of breeds are in the river category, are primarily milk animals and originate in India and Pakistan.

Buffaloes may sometimes yield less milk than cows maintained under identical conditions but in India, for example, the average milking buffalo gives much more milk than the average milking cow. The average annual milk production of 491 kg for the buffalo in India is 2.8 times higher than the annual average of 173 kg for the cow. The number of buffaloes producing

Main Type	Breed	Production
Swamp	<p>Swamp</p> <p>There are a great many local varieties, varying greatly in size, colour and markings. None of these can be accorded separate breed status.</p> <p>Horns are massive and grow outward from the head in a semi-circle.</p>	<p>Mainly used for work; exhibits great versatility and muscular power.</p> <p>The potential for meat production is outstanding.</p> <p>Small scale milk production from Working animals is general.</p>
River	<p>Murrah Nili-Ravi Kundi (Figure 3) Mehsana Sambalpur Jafarabadi</p> <p>Horns curled and set close to head: may be downswept.</p> <p>Surti (Figure 4) Mediterranean (Figure 5) Egyptian Bhadawari Tarai Nagpuri Pandharpuri Manda Jerangi Kalahandi Toda Kanara</p> <p>Horns sickle-shaped and upswept.</p>	<p>Primarily milk producers, or dual purpose milk/meat animals. Most breeds have good beef characteristics.</p> <p>The production of beef type calves by mating females with beef type males, such as the Swamp, should be greatly extended.</p> <p>Crossbreeding offers great opportunities and should be encouraged.</p>
Desi	<p>Mongrel</p> <p>Local types, nondescript and usually the result of haphazard, uncontrolled breeding. Horns may be of any description but are most usually curled.</p>	<p>Mainly working animals: ploughing, harrowing, road haulage and general draft purposes.</p> <p>Small milk production.</p> <p>Usually good beef potential.</p>

more than 2 kg per day is 188 per 1,000 against the corresponding figure of 3 per 1,000 in cows (Shah, 1967).

In well-managed buffalo dairy farms yields per lactation of 1,000 kg are common. In the best enterprises in Italy, with twice-daily machine milking and a lactation period of 280 days, an average daily yield of 7 kg has become a routine. State and military farms in India and Pakistan record similar yields. In Bulgaria buffaloes often attain a yield of 2,000-2,500 kg per normal lactation period of 300 days while exceptional yields in excess of 3,000 kg have been recorded.

The milk is very rich in both butterfat and in non-fat solids, but is otherwise closely similar in chemical composition, physical properties and acceptability to cows' milk. The average butterfat content is 7 to 8 percent. By feeding on a high concentrate level it can exceed 15 percent.

A great variety of butters, including the dehydrated clarified form known as ghee which is the cooking medium favoured by all Muslims and Hindus, and of cheeses are made from buffalo milk. Many of the cheeses, such as the Italian *mozzarella* and *ricotta*, the *gemir* of Iraq, the *cincho* of Venezuela, and the *pecorino* of Bulgaria are rare delicacies. Buffalo-milk yogurt and curd are also worthy of mention.

It has been postulated that the water buffalo has little or no genetic potential for increased production of milk. This statement is often advanced during revivals of the sterile buffalo *versus* cow argument, but the evidence is insubstantial or sophistic. Kurien (1970), analysing the production performance of buffaloes and of indigenous and crossbred cows, noted that, in 1957, 0.18 percent of buffaloes in India had a daily milk production of over 12 kg. A less comprehensive survey made in 1937 indicated that 0.10 percent of buffaloes were producing 12.6 to 14.4 kg of milk daily. The next most productive 40 percent of buffaloes were producing some 4.5 kg daily in 1957. Use of the top 0.1 percent as nucleus stock, to be bred with the next most productive 30 percent of buffaloes could be expected to produce a buffalo with a lactation yield and conversion efficiency equal to that of most crossbred cows in India. The potential for greater production of milk is at least as good as that of the cows. The same author points to the buffalo as an efficient converter of the coarse roughages which are a byproduct of most farms and which are unsuitable for cows.

Depending upon breed, environment and management, the daily milk yield of buffaloes ranges from the 2 to 4 litres produced by a working draft female to the 16 litres or more of the exceptionally heavy-yielding dairy animal. Buffaloes which combine milk production with work naturally give a lower milk yield than those maintained exclusively for milk.

The lactation period is usually 270 to 300 days. Yields vary with breed, location, nutrition and management from 500 to over 3,000 litres. The gestation period is approximately 310 days for most

breeds. Two calves in three years is usual, though with good management a calf every 14 months is possible from the age of 3-1/2 years to 18 or more. The buffalo is remarkable for its long productive life.

The dairy buffalo approximates closely to the dairy cow in many of its characteristics. Methods of breeding, husbandry, and feeding for milk production that have proved successful for the cow can be applied equally to the dairy buffalo (Kay, 1974). The buffalo has qualities of docility, longevity, and feed conversion possessed by no other domestic animal.

The Beef Buffalo

The classic procedure of mating dairy cows with beef bulls and raising the calves for early slaughter can be profitably applied to buffaloes. The production of buffalo meat from dairy herds by the use of beef type males, for example of the swamp breed, on such milking breeds as the Kundi, the Surti and the Mediterranean offers opportunity for development. The use of deep-frozen semen and the general application of artificial insemination call for research and investigation to bring the techniques to the level of efficiency attained in cattle.

The value and importance of the working buffalo and the milking buffalo have obscured the outstanding potential of the animal for meat production. While much can be done to increase work output and to improve milk yield and quality, it is in the realm of meat production in both developing and advanced countries that the buffalo can make its greatest contribution.

The water buffalo is the ideal animal for feedlots. It is a highly efficient converter, it is not liable to many of the stresses which afflict cattle, by nature it is placid and non-aggressive, and it can be herded and handled with ease. Normal cattle feedlot practices would require only minor and inexpensive adaptation. All buffalo calves should be dishorned at or before the age of 6 months. Males should be castrated at the same time. Shade must be provided but wallows are not necessary, though routine spraying would be beneficial.

The buffalo is a bovine animal and there is nothing peculiar about its flesh. It does not have a "buffalo flavour." It is not second best to cattle beef. It can stand on its own merits and deserves recognition as a meat fit to rank with the best of beef by a meat-hungry but discriminating public. There are no significant differences. The two meats are closely similar in chemical and physical properties. Buffalo meat differs from cattle meat only in having less fat and being more tender.

Results obtained in Bulgaria and Yugoslavia showed daily weight gains of over 1 kg. De Franciscis (1971) in Italy, and Mesbah, *et al.* (1973), in Egypt have convincingly demonstrated that the early weaning of buffalo calves and subsequent rearing for beef production, with slaughter at around one year of age at a live-weight of 300-320 kg, is perfectly feasible. A

highly satisfactory yield of top-quality beef is obtained at a much lower cost than with cattle. Dressed carcass percentages range between 50 and 58 percent and the meat component is around 70 percent of the meat-bone total.

Much useful work on buffalo meat production has been done in Australia in recent years. It is only since 1968 that the production of the feral buffaloes has come to be appreciated. Until then the buffaloes of the Northern Territory had been regarded as a pest, to be cropped for the hides as expedient, and eliminated if possible. The work of Tulloch (1970, 1974), who first studied the behaviour of the feral buffaloes and who demonstrated the ease with which they can be tamed and domesticated, has opened the way to a new industry in the Top End of Australia's Northern Territory.

Charles and Johnson (1972:1975) have demonstrated that buffalo carcasses are well suited to the lean meat market and have a higher dressing-out percentage than those of the *Bos* species. They have shown that castration makes little difference to the carcass characteristics of the swamp buffalo, and that even on high-gain rations the carcasses will be lean. Average weight gains in four feedlot groups, each of five 200 to 300 kg, 11 to 20-month-old steers, fed lucerne hay or pellet rations for 3 to 5 months were 0.5 to 0.74 kg/day. Fattening periods were three to five months and slaughter was at liveweights of 300 to 480 kg. It is suggested that buffalo steers will only become overfat after prolonged feeding to weights well above commercial targets. Excess fat, i.e., over 20 percent, was produced only after a long stay in the feedlot and in the oldest of the steers. A comparative study which confirmed the resistance of the buffalo to fattening was made with Hereford, Friesian, Angus and swamp buffalo steers which were fed concentrate rations from 3 to 7 months. All breeds except the Angus put on the same amount of muscle but differing amounts of fat. The buffaloes finished with much leaner carcasses.

For many centuries buffaloes were bred and kept for work. This led to the evolution of animals of powerful muscular development. Until relatively recent times little attention was given to the exploitation of this potential for quality meat supplies. Most of the buffalo meat was, and still is, derived from animals slaughtered in emergency or at the end of a useful working or productive life. As a result, the meat is generally of poor quality and is often unattractive in appearance. Rearing buffaloes for meat production is still in the early stages of organization but already shows promise of rapid expansion in many countries. The wide variation in size and weight of buffaloes in different countries, ranging from 250 to 1,000 kg or more, indicates a considerable potential for selection for breeding. However, it is vital to ensure that improvements in management, nutrition and health protection keep pace with breed development. Research programs on many aspects of meat production are underway at centres in

Australia, Bulgaria, Egypt, India, Italy, Romania, Trinidad, U.S.S.R. and Yugoslavia (FAO, 1977).

The buffalo is an animal not of the past but for the future. An important part of that future lies in its potential as a source of quality meat. If the buffalo is reared and fed for meat production the meat is tender, palatable, of high quality and acceptable to the consumer. It can be obtained at less expense and with fewer inputs than that from cattle and, in tropical and sub-tropical countries particularly, at a much earlier age.

Health

It is unfortunate that some of the best buffaloes, especially those of the river breeds, exist in areas where the incidence of certain infections or contagious diseases is such that many countries, and in particular those in the West, refuse to countenance the importation of these animals. Some developing countries, following the example of most of the advanced ones, will not accept the risk of importing from such sources even when such risks can be reduced to negligible proportions. Systems of close and prolonged quarantine, under maximum security conditions, allowing for the application of detailed tests with constant veterinary supervision, at both export and import points, minimize the danger and render possible the introduction of nucleus breeding herds of appropriate breeds even into countries where buffaloes have not previously existed. It is considered worthwhile to accept such greatly reduced risk in order to add a highly productive source of protein to animal agriculture.

The water buffalo must be seen as an animal with a phenomenal production future, not only in tropical and sub-tropical countries but in many of those in temperate zones also. The dairying and meat production industries, which have had an important supporting role in the evolution of social systems, are now taking a leading position in raising standards of living.

As a bovine animal the buffalo is as susceptible to the majority of infectious conditions as are cattle. Opinions are sometimes expressed that water buffaloes are resistant or even immune to many of the infections of cattle and other species. It is true that some diseases are less prevalent in buffaloes than in cattle or are less harmful; others, however, are more prevalent and more harmful, while a limited number of disease conditions and parasitisms of minor economic importance appear to be specific to buffaloes. Reaction to some diseases seems to vary with geographical location, environment and breed, but it can be accepted that unvaccinated buffaloes have little or no resistance to the major epizootics such as rinderpest and foot-and-mouth disease. The myth of their immunity to tuberculosis and the infectious infertilities has long since been exploded. In the author's experience mastitis is not of such frequent occurrence as in cattle and is seldom seen in the acute form. Similarly, pathogenic processes of the feet, such as foot rot and foot abscess, are extremely rare in

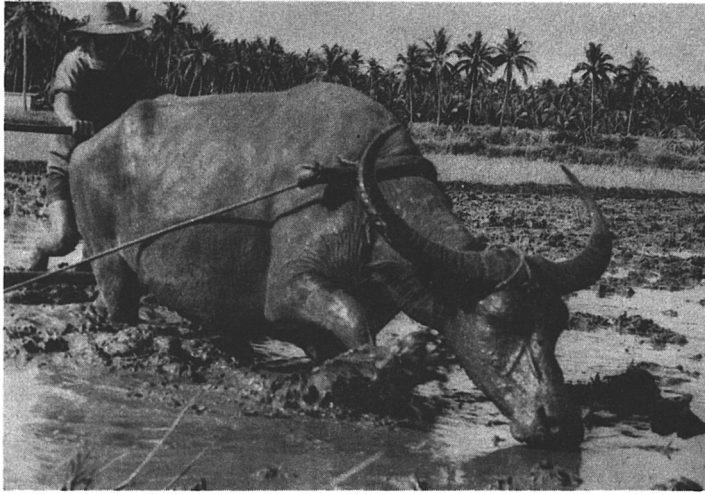


Figure 1. Harrowing a padi field before planting rice in the Philippines. The breed is the Swamp buffalo, which frequently weighs over 1,000 kg. (FAO photo)

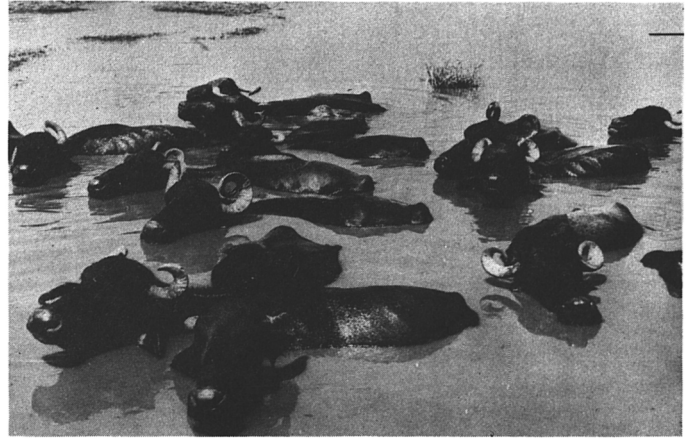


Figure 2. River buffaloes wallowing. (FAO photo by A. Welle)

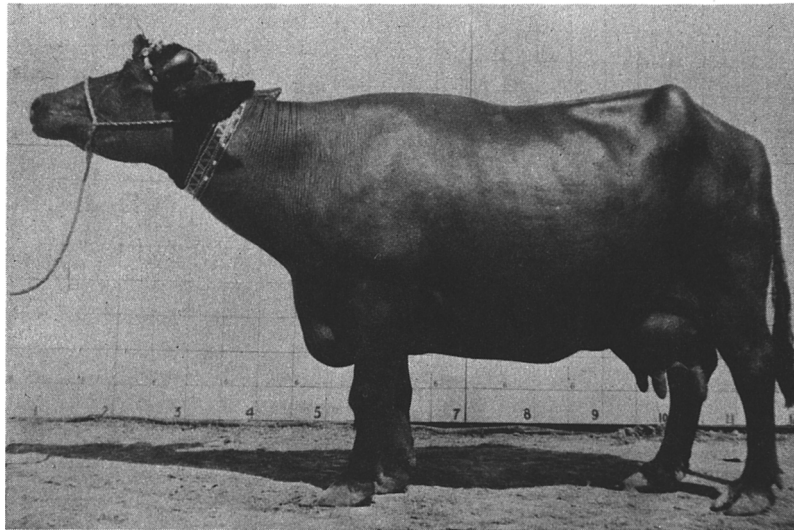


Figure 3. Kundi buffalo, Pakistan. (Photo by Abdul Wahid)



Figure 4. Male Surti buffalo, India. (FAO photo by Peyton Johnson)



Figure 5. Mediterranean buffalo, Caserta, Italy. (FAO photo by Peyton Johnson)

buffaloes. There is a noticeable resistance, unfortunately not absolute, to tick infestation. This is often and erroneously attributed to the thickness of the hide. The hide is certainly thicker and heavier than in most breeds of cattle and is very vascular. There is no immunity to piroplasmiasis, trypanosomiasis, and East Coast fever. Buffaloes, by virtue of their habitat and wallowing proclivity, are subject to heavy infection with *Fasciola spp.* which may cause loss in production and reduced work ability. Although the liver may suffer extensive and irreparable damage and the parasite load may be phenomenally heavy, clinical signs are usually lacking. *Neoscaris vitulorum* infection, which may be acquired prenatally, or through the colostrum, causes heavy losses in untreated buffalo calves in which the small intestine may be packed almost to the point of complete occlusion.

Although the buffalo presents some characteristic features, and some of these may appear to be unique, it is a bovine animal and its response to infection is very close to that of cattle. When maintained under good conditions of health control, it is remarkable for its long productive life. There is some truth in the aphorism that a sick buffalo is a dead buffalo.

The Future of the Water Buffalo

Within recent times the following importations of nucleus buffalo breeding stocks have been made:

By	From
Brazil	India, Italy, Trinidad
Bolivia	Brazil
Bulgaria	India, Pakistan
China	India, Pakistan
Colombia	Trinidad
Costa Rica	Australia
Mozambique	Italy
Nigeria	Australia
Papua New Guinea	Australia
Tanzania	Egypt
Uganda	India
U.S.S.R.	India
Venezuela	Trinidad, Italy,
Bulgaria and Australia	

Some of these importations, e.g., by Costa Rica, have been small and experimental; others, like those by Brazil, Mozambique, Nigeria, U.S.S.R. and Venezuela, have consisted of some hundreds of animals repeated on several occasions and designed

to boost existing populations where there is an obvious commitment to the future of the buffalo.

The United States does not appear, at present, to share the upsurge of international interest in the domestic water buffalo, or even to seek to experiment, under strictly controlled conditions, with trial importations of representative breeds. It is difficult to believe that U.S. scientists are unaware of important developments in other parts of the world, or are oblivious to the enormous potential presented by this hitherto neglected animal. Dr. Hugh Popenoe at the University of Florida has successfully established a small unit at Gainesville and is convinced of the possibilities that lie in the future exploitation of the animal.

In Italy and elsewhere the water buffalo has amply demonstrated its claim to an important place in western agriculture. In the developing countries the numbers of buffaloes maintained for milk and meat production are greatly increasing. Scientific interest in stimulating production through intensive studies and research is growing everywhere.

The future for this attractive, tractable, productive animal appears to be a bright one in which the promise of an outstanding contribution of animal protein in the form of high-grade milk and top-quality meat will not go unfulfilled.

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