

Buffalo Newsletter



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PROCEEDINGS OF THE WORKSHOP ON EXPERIENCES IN BUFFALO NUTRITION

MUSTAFA KEMAL UNIVERSITY - ANTAKYA, TURKEY, 8-10 OCTOBER 1998

From the Coordinator of the FAO Buffalo Research Network

I think that everybody is aware of the evolution of the Buffalo Network, which was conceived by FAO to promote the exchange of information between researchers of the different countries with the aim to further develop and improve buffalo production. Among the performed activities we remind you of the four specific symposia (products, reproduction, production systems and state of the research) and the publication of the Buffalo newsletter.

We believe that we have succeeded in establishing good and steady contacts in each country and we thank the national coordinators who have cooperated with us in this respect. The network is now ready to engage itself in more involving actions, for example to afford the major constraints affecting the improvement of buffalo production and make proposals to overtake them.

In this respect the present Workshop was planned. We wanted in fact to start a debate from practical farm experiences. Three buffalo farmers were therefore invited to talk about their farms and problems. We have also

contacted the best known animal nutritionists in the member countries inviting them to the debate on the experience of the farmers. Nutrition scientists from Turkey, Italy, Egypt and Iraq have participated. The most important part of the Workshop has been the discussion arising from the farmers experience, discussion which was lead by a chairman/moderator (Prof. Bertoni, University of Piacenza, Italy). A list of recommendations was drafted at the end of the Workshop by the Chairman with the help of a Rapporteur (Prof. Adel Jumah, University of Baghdad, Iraq) and a Secretary (Dr. A. Cannas, University of Sassari, Italy). The National coordinators of the member countries who have participated in the Workshop have the task to inform the researchers in buffalo nutrition of their countries on the results of the Workshop in order to involve them in the future activities and projects that will be planned within the Buffalo network.

I would like that all readers of the Buffalo newsletter get useful information from the Proceedings of this Workshop and invite any reader wanting to describe his experience or problems to get in touch with us, so that the

discussion on "Buffalo nutrition" which was started in Turkey will continue through the newsletter.

Finally, I want to thank Prof. Sekerden who organized the Workshop at the Mustafa Kemal University in a superb way including very interesting technical visits and enjoyable social events. Thanks also to the Rector of the Mustafa Kemal University, to the Governor of Hatay, and to FAO Regional officers who have supported the Workshop through financial contributions.

G. Rossi

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EVOLUTION AND PERSPECTIVES OF A BUFFALO FARM IN THE CASERTA AREA (ITALY)

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A) GEOGRAPHICAL AREA AND BACKGROUND

The "Agricola Volturmo Farm" is located in a hilly area, in the Caserta province and in the valley of the Volturmo river. Winters are always very cold and Springs register highly variable temperatures which have a very bad effect on buffalo reproduction. The farm covers a surface of 3 hectares with shelters, milking parlour, hay and silage stores, offices and houses for part of the staff. It was established, as cooperative farm, in 1989 with the main goal of selling buffalo milk to dairies. A recent Governmental law, in fact, foresaw particular financial advantages for young people who wanted to start an activity on their own. The farm project was approved in 1992. In the same year the building of the farm started. Milk sales started in April 1993 and the first calvers were milked with a portable milking machine. In May 1993 the milking parlour was ready. The farm has always been assisted by the Livestock Science Division of the University of Naples so that the most innovative technologies were followed.

B) SHELTERS FOR BUFFALOES

Buffaloes are kept on paddocks made of concrete, with feeding corridors allowing the driving of tractors and unifeed (i.e. total mixed ration) mixer. Daily cleaning is performed by excavators which throw the manure in appropriate storing basins. Manure will be then distributed on the fields. Daily cleaning of the paddocks, together with the careful washing of the udder before milking, make the number of bacteria to be at a much lower level than the one allowed for buffalo milk (law 84/97). Also udder health is favoured: somatic cells are in fact < 200,000 averagely in a year. Beside the concrete paddocks, there are paddocks directly on the ground, which allow buffaloes to walk during Spring and Summer. Paddocks are 90 m long and 15 m wide. Paddocks for lactating buffaloes have a 3 m tall wall on the North side to protect them from winds and are also provided with showers for hot Summer hours. Milking parlour and milk tank are at the centre of the farm. The milking parlour is of "tandem" type, allowing the milking of 12 buffaloes at the same time. Milking is controlled through connection with an electronic program for herd management.

C) BUFFALO GROUPS

Buffaloes are divided in groups according to the days from calving. In our farm strong efforts are in course to modify the calving season (from Autumn to Spring). In Spring and Summer, when

milk yield is the highest, we make three groups: 1. older buffaloes, 2. first calvers, 3. buffaloes milked once a day (for those who are 2 months before the dry-off and produce less than 5 kg milk/day). In this way food is more easily distributed. In Winter, i.e. when milk yield decreases, we make only two groups: 1. twice a day milked buffaloes and 2. once a day milked ones. Heifers and non-lactating buffaloes are divided in four groups according to age and pregnancy stage. The dried-off animals are taken to the calving paddock one month before calving.

D) REARING OF THE REPLACEMENT

We aim to increase individual milk production by performing AI in the season in which reproductive activity is more regular; in the future and for the high-yielding buffaloes we aim to perform AI all over the year.

At present, we cull buffaloes having produced less than the herd average during 2-3 lactations. We put in the herd every year more heifers (8%-14%) than requested by the compulsory culling rate. Therefore we must put much more care in the rearing of the heifers.

Calves are taken away from the dam immediately at birth. They are put in weaning cages located in a building made of reinforced concrete. They receive a bucket of colostrum within 4 hours from birth. They are kept in the cages until they show to be adapted to artificial milk feeding. They are then divided into weaning groups and are fed with a special milk (pH=5.7), given cold, ad libitum, at a concentration of 18% and till the age of 40-50 days. Milk formula was produced by the University of Naples together with a Dutch Company. Calves are then moved to another group, they are fed with the same amount of milk but 20 per cent less concentrated than the previous (148 grams sour instant powder/1 litre water). Calves are fully weaned between the age of 60 and 70 days, when they are at least 70 kg liveweight. During weaning they get silage, hay and a weaning concentrate containing skimmed milk powder and lactic acid bacteria, with the following characteristics:

Dry matter	Crude protein	Ether extract	Fiber (Wende)	Starch	UFL	Ca	P
%	%	%	%	%	%	%	%
88.0	17.6	3.1	13	16.5	0.90	0.47	0.45

After weaning, calves are kept in one group until they are 10 months old. They register a decrease in the growth rate during the first 30 days after weaning, likely due to competition within the group.

follows page 5

We are therefore planning to build a shelter for the calves so that it will be possible to divide them into the following age groups: weaning to 6 months; 6 to 12 months; heifers ready for the bull; pregnant heifers.

E) FEEDING

Available land consists of 44 hectares producing forages for the 220 adult buffaloes and the 120 young stock. Eighty per cent of land produce two crops every year: maize +ryegrass. Alfalfa is sown in May on 6 hectares; on the remaining 3 hectares only maize is grown. In this way 54% of dry matter requirements are satisfied. In practice, all maize and the majority of ryegrass for silage are produced in the farm, while hay satisfies only 13.2% of the requirements. The remaining forages (straw and some hay) and all concentrates are purchased. Table 1 refers the basic data of forage production and costs.

Table 1. Forage production, seeding time, losses after silage and hay making, net costs after considering losses (net UFL).

	seeding time	crop time	yield/Ha in 100 kg dry matter	costs/Ha in It. Lire	losses after making silage/hay	cost/kg net UFL
maize only crop	May 1 ^a	begin September	186	1,800,000	26	152
maize after ryegrass	May 25 ^a	mid-end September	157	2,200,000	26	220
ryegrass for silage	Sept.-Nov.	begin May	60	1,550,000	30	461
ryegrass for hay	Sept.-Nov.	mid-May	50	1,300,000	10	438
alfalfa	May		100	1,200,000	10	222

Seeding time and crops are very much affected by the location of the farm in a very cold and rainy area. For this reason, seeding of maize grown as the only crop is delayed and yields are not much higher than those obtained with maize in double crop. Moreover, when September is particularly rainy, maize siling is difficult, and losses can be up to 26%. Also ryegrass yields are lower than those obtained in areas located 30 km further away. In fact, Springs are also rainy and pre-drying on the field is highly affected. We plan to modify silos by reducing the front area so that spring fermentations will be lessened. In order to reduce hay losses we are planning to make sheafed balls. We are also planning to modify our crops because we believe that UFL given from ryegrass is too expensive; the new plan might be as follows: 38 ha maize as the only crop, 6 ha alfalfa, 5.75% of required silage, 70.2% of required hay and 100% of straw might be purchased. With the new plan, costs might be reduced by 21.5%.

F) RATIONS

In table 2 the different rations are reported. Diets have changed during the years, due to the increase in buffalo productivity. In the past, lower protein and lower energy diets (14% and 0.82 UFL) were given. Since 1996 both levels were increased (see table 2). From February to September, when 80%

of calving occur, diet is particularly rich. From October to January, when average days from calving are 120-210, diet is lower in energy but with the same protein concentration.

Table 2- Chemical characteristics of diets for lactating buffaloes in the following periods: P1-Spring-Summer; P2-Winter; P3-for only once milked buffaloes; As-dried-off buffaloes; An-female calves; MT-heifers ready for the bull.

Group	P1	P2	P3	As	An	MT
Dry matter (dm) (kg)	16.6	16.9	12.7	9.0	6.6	8.2
UFL/dm %	0.945	0.872	0.830	0.620	0.76	0.76
Crude protein/dm %	15.65	15.14	14.29	8.97	11.41	11.41
Ether extract/dm %	5.55	3.55	3.91	2.35	2.52	2.52
Fiber (Wende)/dm %	18.10	18.35	20.22	32.50	26.50	26.50
Ashes/dm %	9.43	7.00	10.45	8.52	9.71	9.71
Starch/dm %	16.70	15.30	17.38	9.04	11.11	11.11
NDF/dm %	38.63	42.39	44.54	66.16	54.85	54.85
ADF/dm %	22.00	23.19	24.58	40.40	31.91	31.91
NSC/dm %	30.80	31.91	26.81	14.00	21.51	21.51
Ca/dm %	0.72	0.81	0.80	0.30	0.37	0.37
P/dm %	0.35	0.43	0.42	0.38	0.41	0.41
F:C	48:52	52:48	55:45	72:28	73:27	73:27

It might look exaggerated to feed 11 UFL to buffaloes which produce only 5 kg milk; however, we have experienced that the reduction in protein and energy level at end lactation causes an early dry-off and high economic loss. But it must be considered that the required UFL for maintenance are 5.76 and the remaining 5 correspond to the production of 5 kg milk, which is much richer in fat and protein at end lactation.

In 1996 and 1997 we registered an increase in average lactation yield by 2.2% and 4.9% respectively, corresponding to an increase in the total income per head and per lactation by It. Lire 121,000 and 268,000, while feeding costs increased only by It. Lire 160,000. The increase is evident in particular for older buffaloes (>8.25%). The ratio Ca:P in dried-off buffalo diets was also modified from 1.14:1 to 1:1.3; in this way the rate of prolapses was reduced from 11.6% in 1993 to 4% in 1995-1996-1997 and to 0.4% in 1997. We think that such good result was obtained also because the two minerals were no more added to the ration as powder but a special mix of Ca:P in the ratio 1:2.2 was prepared and mixed in advance in the unifeed mixer.

Female calves and heifers are fed the same diet as males because we want to increase body weight and reach an earlier puberty. In Winter, less rich rations are fed in order to obtain a daily gain of no more than 400 g/day. We experienced that alternation of high energy with low energy levels two months before giving heifers to the bull improves their reproductive performances.

FOLLOWS PAGE 4 

G) CALVING DISTRIBUTION AND METHODS USED TO MODIFY CALVING SEASON

Mozzarella cheese demand is the highest in Summer, therefore we were compelled to adopt methods to avoid Autumn calving in order to have more milk in Summer. In the first year of activity calvings were badly programmed due to shortage of money and difficulties in the purchase of heifers (graph 1). Despite of this, milk sold during Spring-Summer was 58% of the amount sold in the year. In the following years, in the same months we marketed 56% to 60% of milk. This last value reflects the market milk demand.

The methods used to avoid calvings in the non-wanted season varied according to replacement rate, fertility, births. At the beginning, we took away the bull from the paddock from October to mid-March. Later, we have allowed the bull in the paddock one month earlier (Sept. 30th-Feb. 15th). The second method, employed since 1995, looked more satisfying. The graphs show in fact that the number of older buffaloes calving in the wanted season is increasing since 1996. This particular calving distribution allowed also to perform AI from Dec. 1997 to Feb. 1998.

A different method is used for heifers, where the bull is allowed also from mid-March to end August. In fact, in this group, a sufficient number of days between calving and the day in which the bull is taken away must be ensured. By anticipating the date in which the bull is taken away from the non-pregnant heifers, we make the heifers to calve not later than June, therefore first calvers have more than 90 days in which they can get pregnant (June 30th-Sept. 30th).

It is known that the adoption of methods to avoid calvings in the non-wanted season increases calving interval and decreases the annual average milk production. As indicated in table 3, calving interval (days) calculated separately for first calvers and older cows ranges from 523 days (1994) to 457 days (1996) in first calvers, while for older cows

the highest values of 517 was registered in 1994 and the lowest of 429 in 1996. The higher annual replacement rate increases the calving interval but improves the fertility of the herd. In fact, it is evident from table 3 that fertility in first calvers is always higher than in older cows. It is also known that seasonal calving is more accentuated in older cows, which are more sensitive to the bull effect and might have a slower uterus involution due to altered mineral metabolism.

During the first two years of activity, the fertility loss in the herd (=no. of buffaloes which did not calve in the following year) was 39%, because the bull was only for 5 months left in the paddock (7 months is the average time when activity is regular) (table 3). This occurred because many buffaloes had calved shortly before the bull was removed (graph 1 - page 5). In the following years fertility loss was reduced to 20%, which is considered an optimum value for those herds in which a programme to avoid calvings in the non-wanted season is being applied. The further fertility decrease in 1997 depends only on the reduction in the available square meters for each animal. In fact, a decrease in the conception rate was observed when days were getting shorter, time in which, on the contrary, reproductive activity should be more intense. At that time, however, buffaloes had only 9 square meters of paddock available each, which is considered insufficient space. More recently, having decreased the number of lactating buffaloes and therefore increased the available space, fertility seems also improved. In order to increase the number of lactating buffaloes, we are planning to build new shelters for the heifers, in order to allow 15 square meters to each older buffalo.

H) GENETIC IMPROVEMENT

When the farm was created, we purchased pregnant heifers, non-pregnant heifers and female calves from officially milk recorded farms having registered the highest milk yield and in good sanitary state (neither brucellosis or tuberculosis in the past ten years). In table 4 (page 6) average lactation yields are reported (column 1 to 5).

Buffaloes are divided according to the farm of origin (row 1 to 5). The number of buffaloes is indicated under the lactation yield. In the same table, age at first calving, culling rate and annual production (1992) of the farm of origin of the purchased heifers is also reported (column 6 to 10).

It is evident that the best buffaloes are from farm no. 2, the top farm in Italy for many years, from which farm no. 1 has purchased the bulls which bred the heifers that we purchased from farm no. 1. During first lactation we registered statistically different milk yields for first calvers according to the farm of origin. In the following lactation, differences are not so evident because culling rates were different for buffaloes from different farms (table 4).

More that 60 per cent of the purchased buffaloes

Table 3: Productive and reproductive patterns in the "Agricola Volturmo" farm.

	1993	1994	1995	1996	1997
no. present buffaloes	86	150	157	152	162
no. first calvers	86	66	29	38	52
no. calvings	86	117	121	173	162
no. pregnant culled	0	0	16	30	32
no. non-pregnant culled	2	0	6	13	10
calving interval (days)	496	520	463	436	475
calving interval (first calvers)	496	523	480	457	482
calving interval (older buffaloes)	-	517	458	429	470
Fertility (%)	60.7	61.3	86.0	79.6	72.0
Fertility (first calvers) (%)	60.7	71.2	89.7	86.1	70.0
Average milk yield (year) (kg)	-	-	-	2246	2390
Lactation milk yield (first calvers) (kg)	1987	2141	2075	2132	2002
Lactation milk yield (older buffaloes) (kg)	-	2596	2489	2606	2721
Lactation milk yield (all buffaloes)(kg)	1987	2332	2372	2427	2494

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Graph 1: Percentage of calvings per month by year (white-first calves; grey-older buffaloes).

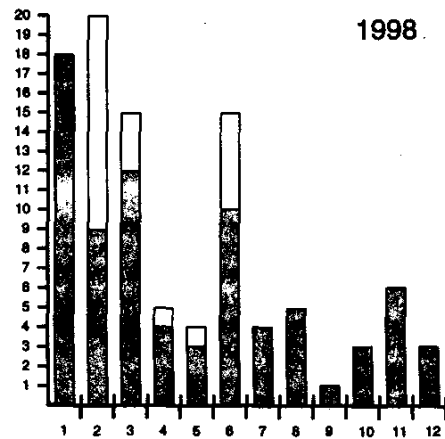
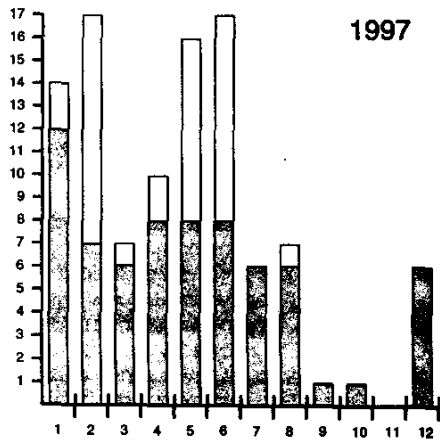
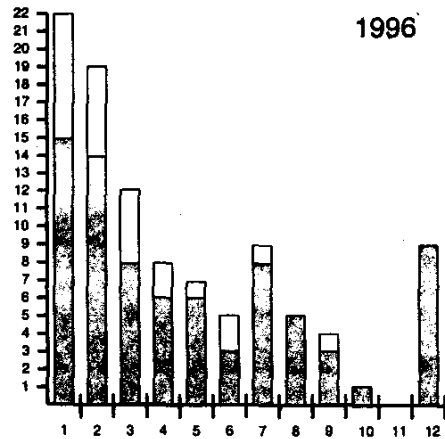
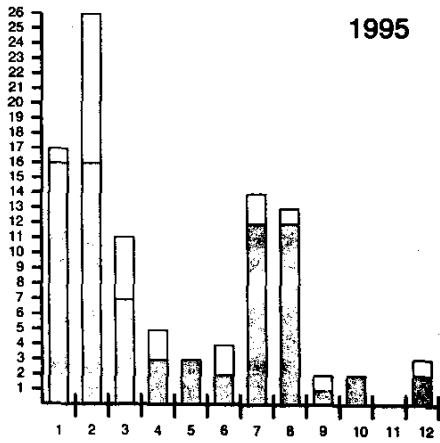
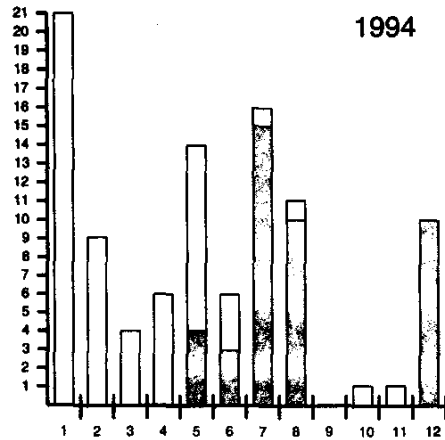
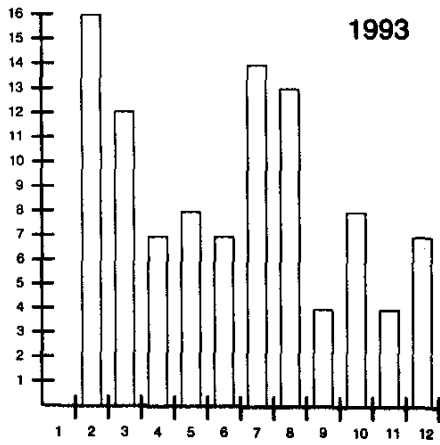




Table 4. Average lactation yields, age at first calving, culling rate as well as annual production in 1998 in the farms where the buffaloes were purchased.

Farm	1 (kg)	2 (kg)	3 (kg)	4 (kg)	5 (kg)	age 1 st calving (days)	culling rate (%)	annual yield 1992 (kg)	annual yield 1992 first calvers (kg)	annual yield 1992 older buffaloes (kg)
1	1979 (55)	2523 ab (55)	2499a (40)	2843 (21)	2882 (5)	1113 (55)	47.3	1658 (158)	1917 (31)	2034 (107)
2	2183 a (86)	2759a (80)	2832b (60)	3168 (26)	2884 (10)	1163 (86)	39.5	2445 (201)	2452 (48)	2714 (130)
3	1835bc (32)	2293b (23)	2703 (4)	-	-	981 (32)	65.6	2318 (205)	2346 (78)	2567 (171)
4	1764c (16)	2197b (15)	2842 (5)	2813 (4)	2500 (1)	-	75.0	1814 (206)	1806 (10)	1965 (116)
5	2102bc (6)	2392b (5)	2876 (4)	2800 (1)	2340 (1)	1105 (6)	33.3	2332 (125)	2359 (23)	2558 (84)

Different letters on the same column indicate statistical significance for P<0.06.

1) G. Campanile (speaker), A. Cannas, G. Bertoni, A. Jumah (drafting committee).
2) G. Rossi. 3) O. Sekerden.

from farm no. 2 had an average lactation yield of about 2900 kg; some of them in third lactation overtook 4000 kg; calving interval ranged from 380 to 440 days. A few high yielding animals (> 2700 kg) were even culled for udder damages or death.

Our policy, consisting of culling all buffaloes yielding below the herd average, has led to an increase in milk production, particularly evident in older buffaloes: + 8.2% from 1995 to 1997. The same does not apply to the first calvers. In fact, in 1997, they registered lower milk yields than in the previous years (table 3). But if the average is calculated without taking into account the animals purchased as calves from farm no.3, the new value is 2300 kg.

Economic loss deriving from our choice of keeping a very high replacement rate is reduced by the fact that we do not sell culled buffaloes to the slaughter house, but because they are pregnant buffaloes with expected Spring calving, their market price is quite high.

Moreover, several buffaloes were served by AI from end December to beginning February in 1996-997 and 1997-998. During the first year, about 30 buffaloes were synchronized and the conception rate was low (26%). The following year, podometers were used, and a conception rate of

50% was obtained.

In the future, as far as bulls of high genetic merit will be available, AI will be performed on the best 20-30% buffaloes, during all year.

Seven super-ovulations on 5 buffaloes were performed, recovering 4.83 embryos per buffalo (min=0, max=17). Five embryos were transplanted into recipients but no calf was born yet. We plan to transfer the remaining 18 embryos next Winter into older buffaloes.

I would like to thank all members of the cooperative farm who have always been trustful in all innovations implemented through the collaboration with the Livestock Division of the University of Naples, of which I also am part. A special thank is to prof. Luigi Zicarelli, who has followed with enthusiasm the growth of the farm, from the project to the production stage. His precious advise made our farm to become, in few years, one of the most productive farms in Italy. Finally, I would like to remind to everybody dr. Stefano Squadrilli, who had been the pulling force in the establishment of the cooperative farm, and who died at the age of 30 leaving a void among all of us.

EL-TAHIR BUFFALO FARM, EGYPT

Sami El-Tahir

4, Mohamad Yousef Salim Street, Maas Aljadida, Egypt

The family took ownership of the farm in 1930. At that time there were no more than 10 buffaloes. In 1985 efforts started to enlarge the holding to 100 mature females and 70 young animals. The area of the farm is 60 acres and the farm is irrigated by the river Nile.

Location: The farm is located east of the Nile delta and 50 km from the Suez canal. Moderate climate exists throughout the year. The temperature is 20-28 °C except in July (30-36 °C), January and February (5-15 °C). The temperature may drop down during some nights to -2 °C. Rainfall is scarce and intermittent in winter. The soil is generally sandy.

The barns are of the open type. Animals are kept loose and in groups according to age and number. Each barn has a long manger. Animals stand on a concrete floor while eating and being milked. We have stopped washing the floor in favor of scraping it mechanically prior to milking. During the night animals lay down on an unpaved inner area.

Each barn has a wallowing pool where animals lay during the day. The pool is a necessity; it improves animal performance and disease resistance. The design of wallowing pools varies with location in Egypt. In our farm we found a small irrigation canal. We enlarged it and made it as the side of our long barn. Along one side of the canal we erected a perpendicular concrete wall while on the other side we built a slanting concrete platform to facilitate the animals with easy access to water. A water pump owned by the family changes the water of the pool thus providing the farms and neighbouring farms with irrigation water.

Hand milking is performed by experienced milkmaids whose husbands work on the farm. This increases family income. Feasibility studies did not warrant at present the introduction of machine milking. However, it will eventually be introduced when the size of the herd is doubled.

One buffalo bull is left free at all times with 50-80 females. Consequently, calving interval is reduced to 13 months. We believe that the wallowing pool has contributed to such reduction. Natural breeding occurs during the night; it seldom occurs during the day. Most newborn calves are sold within 10 days and 25% of selected female calves are retained together with 5 male calves. All animals are very carefully selected. The males are used as breeders on the farm or sold to other farmers. Newborn calves are allowed to suckle their dam and are weaned at 40 days of age or when body weight of 85 kg is attained. Concentrates and green fodder are fed. Birth weight and daily gain are averagely 40 and 1.25 kg respectively. During the 15 days post weaning, gain in weight is negligible but thereafter it improves. Winter born calves are usually culled due to difficulties pertinent to environmental

conditions. Artificial suckling is not satisfactory for various reasons.

FEEDING

I am proud of my success in feeding rice straw to animals. I acknowledge with thanks the Animal Research Institute for suggesting the use of this feedstuff and for their cooperation and selling to us both ammonia and plastic sheeting. We are now using ammonia-treated rice straw with added molasses and minerals with very good results. Hence, production cost is reduced significantly. Many participants in this workshop may regard no importance to rice straw as feedstuff. But I request all rice growing countries not to undermine this feedstuff, but to give it their very special consideration.

RICE STRAW PROCESSING FACILITIES:

1. Five open stores with common walls, 1.5 m high and a capacity of 100 tons each. The straw in the first store is covered with plastic sheeting (Egyptian Pounds 500) and injected with ammonia and uncovered at least one month later. The plastic cover is then moved to the second store and so on. The cover thus is reusable but for one year only. The cost of the cover was reduced to Egyptian Pounds 1 per ton.
2. A locally manufactured chopper is powered by a 30 hp electric motor.
3. A blower with a 8-inch suction nozzle that conveys the straw to the mixer.
4. A 30 ton molasses vat with electric motor and pump which pumps molasses to the mixer at a regulated rate. Water soluble minerals are also incorporated in the process.
5. A large straw and molasses mixer. This is operated by one worker who is paid at a fixed fee.

FEEDING THE RICE STRAW:

Rice straw is made available to animals at all times. Thus, the long mangers are filled every evening before the workers leave the premises. We found that 6 balls of untreated straw (80 kg/ball) were sufficient. But the intake increased to 12 balls when ammonia-treated straw was offered. Incorporation of the molasses, however, increased the intake to 20 balls (100 mature and 70 young buffaloes). Since the workers were very pleased with those results, they increased the allowance. Such a step resulted in diarrhoea, loss of weight and lowered feed intake to 15 balls. Nutritionists at the Animal Research Institute, however, advised that the quantity of molasses must not exceed 2 kg/animal. This, of course, is economically in our

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favor. When we reduced the quantity of the molasses, excellent results were obtained; diarrhoea ceased and the animals looked healthier; the average number of balls consumed amounted to 22. This contributed also to the following:

- a. profits were attained from lactating buffaloes fed only 3 kg of concentrates. It increased to 6 kg during the current season (1998-1999) as the level of production returned to its norm.
- b. Dry buffalo cows are kept in good condition by feeding them only one kg of concentrates.
- c. Animals weighing 250-300 kg attain a daily gain in weight of 700 g by utilising 2-2.5 kg of concentrate.

Further increase in gain will be attempted.

The concentrate ration consists of:

40% cottonseed meal	Eg. Pounds 650/ton
35% ground corn	Eg. Pounds 500/ton
15% ground barley	Eg. Pounds 600/ton
10% wheat flour	Eg. Pounds 600/ton

Common salt and Calcium diphosphate are added. For silage making, 5 feddans of corn are cultivated and the silage will be fed to animals in the coming fall. Corn silage making optimises the utilization of corn fields. However, I feel that it is not the long term solution for a country with very limited arable land. Furthermore, the cost of one ton of corn silage is three times one ton of rice straw. In fact, the cost of 1 ton ammonia-treated rice straw with molasses and mineral added is Eg. Pounds 110; while the cost of corn silage is Eg. Pounds 350. I suggest, however, to include both of them in buffalo diets.

Daily allowance of green roughages is 20 kg per lactating cow and 5 kg per growing animal. The green roughage consists of Egyptian clover (40 ton/feddan) during winter, and elephant grass (80 ton/feddan). The latter is a perennial crop (5 years) and many Egyptian farmers do not like it because of its poor winter growth. However, we cultivate it in lines and cultivate the clover in between the lines during winter. Thus, a combination of leguminous and graminous forage crops is facilitated.

The distribution of our buffalo cows according to their daily milk yield is as follows:

no. cows	Daily milk yield (kg)
1	20
1	17 for one month
1	16
More than 10	14
15	12

Lactation milk yield varies: some buffaloes produce more than 3000 kg and many produce over 2000 kg. The potential of genetic progress is high and it is our objective to improve the productivity of our stock. Since there is no marketing board in the country, the purchase of superior milk producers from local markets is not feasible. Consequently,

improvement of our herd is slow.

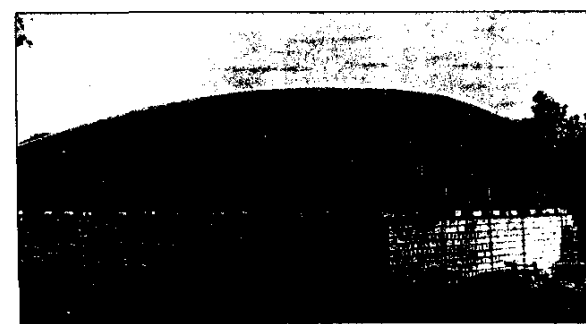
Being a private venture, profit is our major goal. We use the average yield of the buffalo during calving interval as measure of profit. For the herd, we use the average yield in one year, as follows: annual milk production/(no. animals*360).

Therefore, evaluation of a buffalo is determined by the maximum yield (peak), average lactation length and average calving interval.

We have started with 4 kg/day (1533 kg/year) and we were able to increase it to 5 kg/day (1827 kg/year). We expect to reach 6 kg/day (2190 kg/year) during the next five years.

The presence of buffaloes in such a natural environment with wallowing pools of running water reduced the incidence of mastitis (1%) and teat problems (cracking) ceased. The duration of

follows page 9



EL-TAHIR FARM, EGYPT

infection with foot and mouth disease was minimal and with no mortality among young animals. There were a few abortion due to mechanical injury and a very young calf drowned in the wallowing pool while following his dam. All animals with a history of repeated prolapses are culled. Assistance at calving, when needed, is restricted to

the veterinarian.

We have 2 buffaloes which gave birth to twins. We were able to market our products in Misr Aljadida, 80 km away from the farm, where prices are higher and the market is stable.

We thank prof. dr. H.K. Juma, University of Baghdad, who kindly provided the translation from Arabic.

BIZAROM BUFFALO FARM

Haim Rubinchik

Bizarom Buffalo Farm, Israel

INTRODUCTION

The Israeli buffalo farm of Bizarom produces 50,000 litres buffalo milk and 600,000 litres cow milk. Milk is processed at the farm into more than 50 dairy products, among which there is also buffalo mozzarella. The buffalo herd is composed of 46 milking buffaloes and 30 pregnant heifers. Buffaloes were introduced in Israel in 1996 by myself and the Triester farm with the purpose to increase the potential income of the dairy through the introduction of a new product, mozzarella, assuming that the Holstein dairy and the infrastructure would be easily adopted by buffalo. In practice, this turned out not to be true at all and adjustments are still being made to improve buffalo husbandry.

THE BUFFALO PROJECT

Buffaloes were imported from Italy with the assistance of the Italian Breeders Association (AIA); animals were selected from three leading farms and went through a very much demanding veterinary examination. Animals had a maximum age of 6 months to be allowed for the Buck 19 vaccine. After finishing quarantine, they were taken to the Israeli farm being fed with a variety of diets, in order to accustom them to the Israeli feed components. At this stage, one animal was lost due to non-ruminal activity. For about one year they were fed 80% of Holstein calves diets with addition of straw.

Heifers were introduced to the bull at the age of 14 months, a weight of 330 kg, and height at shoulders over 121 cm, being the parameters at first service for Holstein heifers in Israel. First calvings occurred at the age of 26 months, with 30% of vaginal prolapses, some uterus prolapses. Three more heifers died for post-partum complications. Average milk production in first lactation was 1,500 litres.

FEEDING HISTORY

Even though we were aware of the problems in buffalo feeding, we were not able to avoid them. They were the following:

- protein and energy levels,

- mineral ratio in dry buffaloes.

We were assisted by an Italian farmer who performs milking only once a day, while we were milking twice. Therefore our milk yield was lower than expected (see left column in "1997 ration"). After advise that we received during the 5th World Buffalo Congress (October 1997) we partially corrected our feeding system, raising milk production in second lactation by 200 litres per buffalo. However, we did not solve our reproduction problems (see right column in "1998 ration").

CONCLUSION

We are successfully producing buffalo mozzarella as a new dairy product in a very competitive dairy market and our "Buffalo farm" has become a brand name for quality products. Despite of the present trend in Israel dairy farming of profitability decrease, the growing demand for our special products allows for expanding the production.

Our initial assumption that the infrastructure of the very successful Israeli Holstein dairy farming would allow easy integration of buffaloes was wrong. In fact, the amount of adaptations was as great as building a new farm:

- animal housing,
- milking parlour,

follows page 10 



BIZAROM FARM

- milk processing equipment,
- professional staff,
- feeding and nutrition.

As nutrition is concerned, adaptation to Italian feeding system was difficult due to the different components and differences in costs, in particular:

- in most buffalo rearing areas all over the world the advantage of buffalo is the ability of consuming roughage; in Israel, roughage is the most expensive component of the ration;
- unknown factors, as water, soil, minerals, hormones and toxins have also played an important role.

The most urgent nutritional and sanitary problems are:

- pre/post partum prolapses,
- undilated cervix during calving, mainly related to vaginal prolapse before calving,



BIZAROM FARM

- diarrhea and edema of hind legs before calving,
 - hypocalcemia on the day of calving (7.5-8.0 g/dl).
- We wonder whether the above problems are due to nutritional mistakes, or heat stress or other reasons.

We are pleased of our achievements so far and we have reached a stage where no single problem can threaten the enterprise.

Through this project we were compelled to increase our professional knowledge, we were in touch with high professional people and we believe to have obtained a mutual beneficial interaction with our neighbours and colleagues.

I want to give a special thank to AIA, the Animal

Tab. 1: Dry buffalo rations.

COMPOSITION	1997		1998	
	Amount	% of DM	Amount	% of DM
Dry Matter (kg)	10.0		10.0	
Crude Protein (kg)	0.950	9.5	0.900	9.0
DIP (kg)	0.710	7.1	0.676	6.8
UIP (kg)	0.240	2.4	0.224	2.2
NDF (kg)	6.228	62.3	6.100	61.0
ADF (kg)	4.102	41.0	4.100	41.0
Fat (kg)	0.188	1.9	0.190	1.9
Ash (kg)	0.879	8.8	0.879	8.8
Ca (g)	67.631	0.7	40.0	0.4
P (g)	33.816	0.3	33.6	0.3
Salt (g)	20.0	0.2	13.0	1.3
Vitamin A (UI)	60.0		60.0	
Roughage (kg)	5.456	54.6	7.536	75.4
Fresh matter (kg)	11.288	88.6	11.288	88.6
NE _L (Mcal)	12.613	1.26 Mcal/kg	12.889	1.29 Mcal/kg
FEEDSTUFF (kg of DM)				
Wheat straw	4.900		4.412	
Cottonseed	1.000			
Sunflower hulls	2.200		0.003	
Rapeseed meal	0.612		1.141	
Barley grain			3.846	
Gluten feed	0.717			
Sorghum grains	1.000		1.344	
Wheat bran	0.769		0.019	
Urea	0.003		0.013	
Ammonium sulph.	0.013		0.276	
Ca Carbonate	0.019		0.040	
Salt	0.040		0.015	
Premix Vit/Min.	0.015			

Tab. 2: lactating buffalo rations.

COMPOSITION	1997		1998	
	DM intake	% of DM	DM intake	% of DM
Dry Matter (kg)	15.4		16.6	
Crude Protein (kg)	1.980	12.6	2.475	15.0
DIP (kg)	1.354	8.8	1.745	10.6
UIP (kg)	0.626	4.0	0.730	4.4
NDF (kg)	7.348	48.0	6.857	42.0
ADF (kg)	4.426	29.0	3.98	24.0
NSC (kg)	4.193	27.3	4.950	30.0
Starch (kg)	2.947	19.0	3.699	22.4
Fat (kg)	0.446	2.9	0.625	3.8
Ash (kg)	1.269	8.2	1.269	8.2
Ca (g)	156.0	1.0	173.0	1.0
P (g)	66.0	0.4	66.0	0.4
Salt (g)	60.0	0.4	50.0	0.3
Vitamin A (UI)	160.0		300.0	
Roughage (kg)	11.090	72.0	8.573	52.0
Fresh matter (kg)	25.866	60.0	26.722	62.0
NE _L (Mcal)	23.120	1.50 Mcal/kg	25.976	1.57 Mcal/kg
UFL	12.844	0.83 UFL/kg	14.431	0.87 UFL/kg
FEEDSTUFF (kg)				
Vetch hay	5.000		4.000	
Wheat straw	2.000		1.352	
Corn silage	14.000		12.375	
Wheat grains	1.763		0.003	
Soybean meal	0.763		0.911	
Wheat bran	2.001		3.032	
Corn grains			1.000	
Barley grains			2.225	
Cottonseed			1.200	
Rapeseed meal			0.330	
DCP	0.049			
Ca Carbonate	0.122		0.117	
Salt	0.120		0.170	
Premix Vit/Min.	0.040		0.070	

Production Research Institute of Rome, the FAO Buffalo Research Network and the organizers of the Workshop for allowing me to give a presentation of the Israeli buffalo farm.

BUFFALO FEEDING IN TURKEY

O. Sekerden

Mustafa Kemal University, Antakya, Turkey

INTRODUCTION

In Turkey 225,000 buffaloes are reared (1996); in the past 30 years a significant waiving in their number occurred, due to political reasons. In fact, policy makers did not keep a steady opinion on the kind of livestock which had to be supported in the agricultural economy of the country. Despite of this, buffalo farming still plays an important role in the smallholder units.

Buffalo is reared mainly in the Black Sea region, North and Middle Anatolia and Thracem, Mus Diyarbakir, Icel, Antakya, Afyon and Sivas provinces. Approximately 40% of buffalo is in the Black Sea Region (Table 1).

Table 1. Buffalo numbers in Turkey (Anonymous, 1992)

REGION	NUMBER
Middle North	76,280
Aegean	2,740
Marmara	24,090
Mediterranean	2,240
Middle East	69,240
Black Sea	107,930
Middle South	17,330
North East	23,060
South East	29,090
TOTAL	352,000

In Turkey the native Anatolian buffalo breed is the only reared breed. It belongs to the mediterranean breed and has been raised for many centuries in Anatolia. Its body structure is heavier and smaller than the improved buffalo found in other countries. Hair colour varies from brown to black; udder, horns and claws are black. Skin is covered with long hair. During suckling period, hair of the calves is black and bright, then it gets reddish from weaning to 1-1.5 years of age. Lactation milk yield is approximately 800-1000 kg, while adult liveweight is 400-450 kg. In Turkey it is believed that buffalo farming does not require any cost, because they graze wherever it is possible. However, natural pasture areas are decreasing due to the intensification of cattle production and

specialized agricultural productions. The lack of pasture, together with the lack of support dedicated to buffalo farmers and the non existing programs for milk and meat improvement, have caused the reduction in buffalo number. In the small holdings of the villages, buffaloes are reared only for milk production, each unit being composed of 1 to 5 animals.

Buffalo fattening is performed in only a few big units with intensive systems.

FEEDING IN DAIRY UNITS

Buffalo feeding in Turkey varies according to the region, the management, the soil, the climate and the rain. Kocaeli Agricultural Research Institute (former Afyon Buffalo Research Institute) was the only farm where buffaloes were raised in controlled conditions and their performances were recorded until 1996. In december 1996 a small initial research herd was formed by 10 pregnant heifers and two young bulls at Mustafa Kemal University (MKU), Faculty of Agriculture, Antakya. In December 1997, 15 more pregmat heifers were added to the herd. The bulls and the heifers were bought from Bafra District of the Samsun provioce. Today, MKU buffalo herd includes 67 Anatolian buffaloes.

Feeding systems below described are employed in Turkey: in Kocaeli and MKU herds they are different from those used in the other herds.

MUSTAFA KEMAL UNIVERSITY (MKU) FARM

From October to June, feeding consists mainly of pasture. During this period, wheat straw and cottonseed husk are also given as addition. From June to October, pasture is completely dry, therefore animals are fed with Sudan grass, maize or grass silage. Lactating buffaloes, for each 2.5 kg yielded milk, receive 1 kg concentrate mixture

follows page 12 



MKU BUFFALO HERD

with 29% wheat bran, 20% cottonseed sediment, 25% barley, 25% wheat hull, 1% NaCl (14.81 digestible protein and 70 g total digestible nutrients). After birth, for three months, calves suckle two teats of their mothers, while two teats are milked; however, this system can be modified according to the produced milk. At 3 months of age, calves are weaned. From the age of one month, calves are given some hay and concentrate mixture, and the amount of these feedstuff is increased gradually.

follows page 13 



1)-2)-3): MKU buffalo herd.

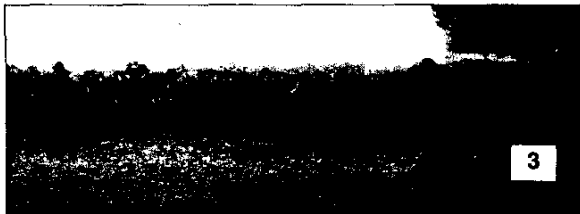


4)-5): Examining buffalo productivity at MKU farm.

FEEDING AT ILIKPINAR VILLAGE (HATAY PROVINCE)

There are approximately 400 buffaloes and 70 cattle in this village, with 430 inhabitants and 40 houses. Feeding is based on pasture all over the year. In winter, lactating buffaloes are kept in the barns and fed with ground wheat, straw, barley, cottonseed pulp. Most of the fodder is produced at the farm. Pregnant animals do not receive any special ration.

After calving, two teats are left for the calves. Calves are sent to pasture at the age of 1.5-2 months. If they are born in summer, they are kept in the barn and fed with grass cut in the garden. Calves suckle from their dam until the age of 8-9 months. When they are 18-24 months old, in their second autumn, they are sold without any intensive fattening. No fattening is either applied to older animals before they are sold to the butcher. Before being sold, they are kept in the barn and are allowed to go out for drinking three times a day.



1) O.Sekerden, K.Mourad and T.Ali at Ilikpinar.
2)-3) Buffaloes at Ilikpinar village.



FEEDING IN OTHER REGIONS

In West and North Anatolia climate is moderate and the best for buffalo farming. Buffaloes are grazed on pasture in spring, summer and half autumn; in winter hay and maize stems are added to pasture. In Middle and East Anatolia, where winters are long and hard, buffaloes are very poorly fed and only lactating buffaloes receive a small amount of wheat bran, barley, vetch hay. Therefore, at the end of the winter, they have bad performances. Buffalo feeding in Turkey varies according to the region, on the basis of the naturally growing available plants. The most popular feedstuff are: hay from barley, wheat, rice; various dried grass, oat, maize stems, sugarbeet sediments, concentrates and various grains. When animals are on pasture, they drink water from lakes and rivers. When they are in the barn they are allowed to go out for drinking twice a day.

At the beginning of the pasture season, in some areas it is not even necessary to give addition to lactating buffaloes. But as the pasture decreases, concentrates are also added.

Buffalo calves are allowed suckling for a long period: they are left with their mothers for 8-9 months. They are still suckling when their mother dries off or when she is pregnant again. During the first 40 days after calving, two teats are left for the calf (three teats are left if the birth occurs in winter). During the following 1.5-2 months, only one teat is left to the calf. Three teats are milked. After weaning, fresh and dried grass, maize stems

and leaves are used in calf feeding; 1-1.5 kg/day concentrate mixture is also given by some farmers in West Anatolia. In some areas, like Bafra region, calves are left all the time with their mothers.

AFYON

In Afyon, buffalo and cattle calves are kept in the same barn for intensive fattening. The following same fodder is used for lactating and fattening buffaloes: cottonseed pulp, bran, sugarbeet sediment, straw, concentrate mixture.

CARSAMBA

In this district, pasture is the basic feeding. In winter, when pasture is not available, maize stems, hay and a small amount of wheat bran and concentrate mixture are given. In summer, males and females of all village are together on pasture from beginning April to end October. In addition, farmers give some wheat bran, to lactating animals. In winter, all farmers use maize stems, soybean and wheat bran. Twenty-two percent of the farmers use also a concentrate mixture. At the end of pregnancy, 58% of the farmers add some oats and bran to the common ration, the remaining do not use any special feeding.

BAFRA

Because buffaloes are allowed to be out from April to October all day long, buffaloes cannot really be considered domestic animals in this area. They

follows page 14

live, mate, eat, calve with no control from humans, except in winter. In Bafra district there is a special wide area called "Fish Lakes" for the great number of lakes. It is a lowland at an altitude of less than 2 meters; in winter the area is fully flooded and used for hunting. In the other seasons, the water is drawn and the area is used for pasture. Buffaloes and cattle are taken to the "Fish Lakes" from beginning spring to end autumn, after having marked them with a special mark, so that the farmers can recognize their animals when they go to collect them at end October.

In many other districts, in summer, buffaloes of the same village are taken to pasture by one man, caring for all of them.

FEEDING IN FATTENING UNITS

In Turkey, intensive fattening of buffaloes is practiced only in the black sea region. There are 50-150 animals in each fattening units of the following places: Samsun province: Bafra, Vezirkopru and Kavak districts; Tokat province: Turhal district; Amasya province (Black sea): Suluova district. However, because the number of dairy buffalo is decreasing, it is more difficult to provide animals for fattening. The main reason for the decreasing in the number of buffaloes in dairy units is the reduction in natural pastures because of the intensification of cattle production and crop production, together with the belief that buffalo production does not necessitate any expenditure. Moreover, the decrease in buffalo number has increased the price of buffaloes for fattening units and these units work at a much lower level than their capacity would allow. Fattening units purchase animals from local market; in the Black sea region, buffaloes from rice growing areas are preferred. Furthermore, fattening units prefer to purchase animals in autumn and winter because they come directly from the pasture. Feedstuff in fattening units ranges from wheat bran, low quality flour, concentrates and broken barley to sunflower pulp, hazelnut, cottonseed, sugarbeet sediment and various hays. Three or four of the above mentioned feeds are mixed and a total of 10-15 kg/day of the mixture is given to the animals in 2-3 times. Some farmers make their own concentrates at the farm. Water for drinking is always available. Concentrates are often diluted and barley, maize, oats or bran are then added in.

Tab. 2: Milk composition (%) at monthly record.

Control Order	N ₁	N ₂	Fat		Ash		Prot		Solids non fat		Total solids	
			1	2	1	2	1	2	1	2	1	2
1	19	54	5.2	5.3	0.83	0.76	4.7	4.4	10.3	8.6	15.5	14.0
2	13	15	5.7	5.5	0.85	0.76	4.5	3.5	8.5	7.9	14.2	13.3
3	9	44	6.3	6.0	0.75	0.77	4.6	3.7	10.0	7.9	16.3	13.9
4	10	41	5.9	6.4	0.74	0.75	4.8	3.8	10.5	8.4	16.4	14.9
5	10	27	6.5	6.8	0.94	0.75	4.8	4.4	9.1	8.4	15.6	15.1
6	5	9	7.1	7.2	0.80	0.77	5.0	4.8	8.7	8.9	15.8	16.1
7	7	-	7.6	-	0.80	-	4.5	-	10.8	-	18.3	-
8	6	-	8.8	-	0.79	-	4.8	-	9.4	-	18.1	-
9	5	-	8.7	-	0.79	-	5.6	-	10.2	-	18.9	-
10	2	-	8.4	-	0.99	-	5.3	-	9.7	-	18.1	-

1: MKU, 2: Ilikpinar

In the areas of sugar factories, fresh sugarbeet sediments and molasses are used at great extent, also adding ground maize. There is no fixed age for buffaloes in fattening: calves, young, adult or old buffaloes are all fattened, depending on the market demand of buffalo meat.

RESEARCHES IN BUFFALO NUTRITION CARRIED OUT IN TURKEY

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Various characteristics of Anatolian buffaloes in Hatay: comparison between the herds of Ilikpinar village and Mustafa Kemal University.

Tab. 1: Milk yield (kg).

Control order (x)	MKU n=19	Ilikpinar n=120	Control order (x)	MKU n=19	Ilikpinar n=120
1	3.8	4.7	6	3.4	3.6
2	5.5	4.6	7	3.0	-
3	5.5	5.0	8	2.8	-
4	4.6	5.2	9	2.0	-
5	4.2	3.9	10	4.2	-

(x) milk recording is performed at one month interval

Tab. 3: Milk composition (%) in the year.

Control Month	N ₁	N ₂	Fat		Ash		Prot		Solids non fat		Total solids	
			1	2	1	2	1	2	1	2	1	2
Jan	11	-	7.2	-	0.92	-	5.1	-	9.5	-	16.7	-
Feb	10	-	6.6	-	0.85	-	4.9	-	10.4	-	17.0	-
Mar	9	-	7.0	-	0.88	-	4.1	-	8.7	-	15.7	-
Apr	7	10	8.0	5.9	0.78	0.77	4.4	4.8	9.0	9.7	17.1	15.6
May	6	31	6.1	5.8	0.76	0.73	5.2	4.7	11.9	8.8	18.0	14.6
Jun	9	35	5.4	5.0	0.82	0.78	4.7	3.2	9.2	7.4	14.6	12.5
Jul	14	44	5.6	5.6	0.92	0.79	4.5	3.4	9.4	7.7	15.0	13.3
Aug	4	54	5.4	6.6	0.81	0.71	5.4	3.7	14.2	8.2	19.7	14.7
Sep	9	47	6.5	6.5	0.72	0.78	4.7	4.6	10.6	8.9	17.0	15.4
Oct	8	-	6.7	-	0.65	-	4.9	-	7.5	-	14.1	-
Nov	6	-	6.6	-	1.00	-	5.5	-	9.6	-	16.1	-
Dec	5	-	6.4	-	0.77	-	5.1	-	10.2	-	16.7	-

1: MKU, 2: Ilikpinar

DISCUSSION

G. BERTONI,

UNIVERSITY OF PIACENZA, ITALY

It appears from the presented papers that in buffalo production there are at least two completely different situations: low yielding (extensive) and high yielding (intensive) systems. Therefore it is difficult to separate the effect of the genetic merit from the management (feeding) effects on the buffalo performances. Furthermore, the problems related to feeding are fully different and concern the supplementation of nitrogen and minerals in the first case, while in the second case major attention has to be paid to the costs of feeds. Our experience suggests that we can conventionally accept that the available knowledge on rumen biochemistry, feed evaluation and nutrient requirements, either directly experimented on buffalo or borrowed from cattle, is sufficient. Nevertheless, some aspects relating to the physiology of the digestive tract, metabolism and endocrine control require a deeper investigation. In particular, the digestive flow as well as the endocrine-metabolic changes should be investigated taking into account genetic merit, production stages, fertility and economic response.

S. BARTOCCI,

ISTITUTO SPERIMENTALE PER LA ZOOTECNIA, ROME.

After the four presentations on four different country realities (Italy, Israel, Turkey and Egypt) the general debate lead to examine more deeply energy and protein requirements in buffaloes. When energy and protein requirements were discussed for lactating buffaloes the position of the Animal Production Research Institute of Rome was also reported. Our position is the result of several trials carried out at the experimental farm of the Institute, in which several diets were compared. We suggest that extremely high energy and protein diets are not to be administered even to lactating buffaloes. Results of our trials indicate that optimum rations consists of 0.84 Milk Forage Units /kg dry matter and 14.5% raw protein during the first 150 days of lactation, and 0.76 Milk Forage Units /kg dry matter and 12.5% raw protein during the remaining part.

Moreover, our trials aimed to: 1. define the feed passage rate in the whole digestive tract ; 2. rumen degradability of raw protein, 3. microbial rumen population in connection with organic matter and carbohydrate digestibility and 4. food intake.

G. CAMPANILE,

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We have deeply studied the Dry Matter Intake and Feeding Behaviour in buffalo. The content in the cellular walls (ADF, NDF, ADL),

and the energy and protein content of the diet may influence the ingestion of Dry Matter (DM). The increase of fibrous fractions and of protein concentration determines a lower DM Intake (DMI), while the increase of the energy content of the diet has an opposite effect. The last statement might be true in developing countries. In Italy, however, where diets are composed of energetic concentrations ranging between 0.88 Milk Forage Units (MFU) and 0.94 MFU per kg DM, a further increase could determine effects which contradict the results referred by Indian researchers. This effect is even enlarged if the increase of energy level is obtained with highly fermentable feed. An energy or protein excess, in fact, increases glycemia which exerts a negative feed-back on the appetite through endocrine-metabolic changes. In Mediterranean buffaloes DMI ranges from 112 to 137g/kg $W^{0.75}$ showing fluctuations between 102 and 164g/kg $W^{0.75}$ according to the open period, to the productive level and to the dietary characteristics. In the last two months of lactation there is a lower DMI (93- 104 g/kg $W^{0.75}$). The intake was negatively conditioned by the cellular walls content (ADF, NDF, ADL) and positively by milk production. In recent studies concerning buffalo feeding behaviour during lactation, it resulted that the DM average intake, after subtraction of the maintenance requirements, is equal to 275g per Kg of equivalent corrected milk. As regards to the influence of lack and/ or excess of nutrients on fertility, I think that the energetic maintenance requirements for buffalo during the different physiological phases may be similar to those reported by French authors for dairy cows (70 kcal NEI/ kg $W^{0.75}$) and that the productive requirements, referring to standard milk/kg (4% fat content), are quite similar to those reported for dairy cows. To verify this, we have reported in the table the results obtained in experiments carried out on Mediterranean buffaloes (Verna et al., 1992/1994). When reading the data in the table it is clear that subtracting or adding the body weight

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DURING THE DISCUSSION

loss or energetic dose accumulation, about 750 kcal of NEL are necessary to produce a kg of milk.

Diet with high or low energy (A/B) and/or protein content (a/b): experimental data (Verna et al., 1992/1993/1994)

	Bb	Ab	Ba	Aa
Milk (kg)	10.67	10.69	10.49	10.48
ECM (kg)	18.52	18.69	17.87	18.56
MFU intake/day	12.63	14.19	13.49	14.17
kg W ^{0.75}	135.6	124.8	126.7	145.9
Weight variation (g/day)	-118	+203	-76	+347
MFU/kg ECM	0.433	0.431	0.489	0.389

These data are confirmed by Mudgal and Kurar (1978) who refer similar values for the production of equivalent corrected milk (ECM); the requirements estimated by Sivaiah and Mudgal in the same year are quite different. They propose 600 kcal of NEL.

The evaluation of the energetic density (MFU/DM) is very important in a diet. It varies according to the shorter buffalo calving period, responsible for the variable calving interval throughout the year. Because there are herds with high-producing buffaloes, the energetic density of the diets is more and more similar to the one used for dairy cows also because the lactation period is shorter in buffaloes than in cows (270 days vs 305 days). This means that for the same quantity of energy produced during a lactation, the daily energetic requirements are higher for buffaloes.

As regards to proteins, in buffaloes, urea levels in blood and milk reached a higher level when a low-protein diet was given for a fairly long period of time. Decreasing occurs when the dietary protein concentrations from high becomes low, i.e. when there is an acute stimulus. Smith (1969) reports that in ruminants living in tropical areas, nitrogen deficiencies decrease the urea kidney clearance, increase ruminal return and decrease haematic levels. Therefore there would be better urea recycling in the digestive tract and better ruminal bacteria proteic synthesis (Houpt, 1970).

With the same ECM value the lower quantity of proteins produced with buffalo milk compared to the cow (31 g vs 27.1 g) allows buffaloes to use low proteic forages. This could explain the adaptation of this species in South America, where forage has a low proteins:energy (P:E) ratio. Anyhow, we must underline that buffaloes react to proteic deficiencies better than dairy cattle.

In Italy the diets used for buffalo have high protein concentrations (between 14.5 and 16.5% CP/DM) and small quantities of fermentable carbohydrates (between 26 and 30 % of NSC). This does not lead

to very bad effects on the production. On the basis of our experience, with the above mentioned diets, NH₃ levels resulted lower than the ones reported by Jordan et al. (1983) in cattle; in these buffaloes an increase of the urea levels in blood and milk and probably a greater elimination of the metabolite through urine occurred. The intake of more proteins increases the metabolic activity of the hepatic microsomes and this favours the transformation into urea of the ammonia coming from food (Visek, 1984).

The results obtained in a study carried out to evaluate the effects of the energy:proteins ratio on milk characteristics and on blood and milk urea levels are the following: 2.53 g of CP/kg W^{0.75} and 2.7 g of CP x g of protein produced with milk. It was referred that the protein concentration used in Mediterranean buffaloes could be lower than 12 % (Verna et al., 1992/1994). The protein concentration depends on the herd's milk yield level and on the days in milk. This changes throughout the year according to the number of of calvings. In our studies we have found that an increase in protein concentration (up to 15% DM) at the beginning of lactation stimulates productive activity without affecting the increase of fat mobilization. NEFA values were lower than those registered in animals that ingested DM with lower levels of CP. It is known that in cattle a higher protein concentration increases milk production because the increase of absorbable proteins makes fat mobilization to occur faster (Orskov et al., 1997; Rulquin, 1992). Post-ruminal casein infusion determines an increase in the percentage of palmitate (König et al., 1984). It seems that high protein concentrations stimulate GH (Oldham et al., 1978-1982) which is responsible for the decreased response of the adipose tissue to insulin, and of a greater sensibility to the adrenergic stimulus at the end of pregnancy and at the beginning of the lactation. These stimulus might be mediated by gastroenteric hormones that can modulate sympathetic nervous system activity (Choung and Chamberlain, 1992). As confirmation of what above, Cadornige and Lopez Diaz (1995) found a greater fat mobilization in cattle that had a higher BCS and fed with diets containing a higher dose of UIP; they also found that their adipose tissue was more sensitive to epinephrine administrations.

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Our Institute has been investigating in the relation between body condition and reproductive efficiency in buffalo, when this species is reared in intensive systems. The evaluation of the fattening condition of each animal of the herd is regularly performed in any intensive dairy herd. From this evaluation, in fact, useful parameters are derived to be used for a correct herd management. The most popular evaluation systems are the following two: the one proposed by ADAS in 1986, based on the palpation of the animals and giving scores ranging from 0 to

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5 by 0.5, and the one proposed by Edmonson et al. in 1989, based on the visual assessment and giving scores ranging from 1 to 5 by 0.25. In dairy cows the two systems have proved to give highly correlated results, but the second is definitely the fastest and applicable in all situations without any stress for the animal. We have tried to apply the Body Condition Score system to the buffalo, by modifying when necessary the system used for dairy cows. The major differences between buffaloes and cows are the following: rump in buffalo shows a well marked sacrum which makes more difficult to evaluate the loin area; buffalo has prominent and wide withers, influencing the fattening status of the back; the breastbone in buffalo is much more variable than in dairy cattle and finally fattened buffaloes in intensive systems look much fatter than dairy cows. After our investigations and trials, we concluded that the area between ilium and ischium as well ilium and ischium themselves are a good indicator of the general body conditions because their shape is correlated with the fat deposit. The loin area, if considered altogether, can also be a good indicator of the general body conditions. As regards to the forequarters, no parameter has been found yet to be a good indicator of the body conditions, due to the high variability of the withers and chest size. We finally emphasize that body condition in buffalo varies very much according to the area of farming. In Asia it is known that buffalo have little or no fat deposit while in Italy fat deposit is very common. We therefore concluded that buffalo shows the most extreme body conditions as regards to fattening compared to other livestock. This fact must be carefully taken into account because of the high correlation between skinny/fat status and productivity/fertility.

In particular, the importance of the evaluation of the body conditions in the replacement heifers has increased. Many farmers in Italy, in fact, in order to reduce the age at first calving (now averaging 38-40 months) perform an intensive feeding programme based on high energy and protein level. Not all scientists agree with this practice which is referred, in some cases, to reduce milk production in first lactation. Recent studies, however, concluded that the administration of highly energetic diets to replacement heifers has no bad effects if a high protein level (19.4%) is also present in the diet or if the age at first calving is over 23 months.

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Our Institute has deeply studied the relation between feeding and prolapses in buffalo. The prolapse of either cervix and/or vagina is the most important pathology affecting buffaloes in Italy at calving time. Prolapses are due to many complex causes but they affect mainly particular animals when triggering events take place. In Italy, we made a few factors evident and we divided them into two groups of factors: predisposing factors and triggering factors.

In the first group we list both congenital conditions

and those acquired after birth, in particular shortage of minerals (Calcium and Phosphorus) occurring before weaning and during prepuberal stages. These conditions prevent to build a well shaped pelvis area and make pelvis ligaments loose.

The triggering factors include those coming from non correct feeding, e.g. shortage or excess of Calcium and Phosphorus, high content of fermentescible elements and/or protein surplus in the diet during the last weeks of pregnancy as well as mouldy feedstuff. Triggering factors include also those coming from infections like clostridia, enterotoxemia, anthrax; those coming from pyelonephritis, cystitis and urethritis and from diseases causing enterites and placenta retention. Triggering factors can also come from traumas, like lacerations in the base, the walls or the top of the vagina and peritoneum due to either calving difficulties or butts. Triggering factors can also be originated by hormonal disorders, e.g. by excess of estrogens during estrus in buffaloes with vaginal or uterus phlogosis.

In Italy, predisposing factors, triggering factors from non correct feeding and triggering factors from infections (except pyelonephritis, cystitis and urethritis which are not very frequent) affect even 40% of the buffaloes during the time going from few weeks before to few weeks after calving. The remaining factors do not occur with the same frequency.

Summarizing what above, factors affecting prolapses originate from:

Predisposing factors		Badly shaped pelvis area; loose pelvis ligaments.
Triggering factors	From feeding	Ca shortage/excess; P shortage/excess; high content of fermentescible elements; protein surplus in the diet; mouldy feedstuff.
	From infections	Clostridia, enterotoxemia, anthrax; pyelonephritis, cystitis and urethritis; diseases causing enterites and placenta retention.
	From traumas	Lacerations in the base, the walls or the top of the vagina; lacerations in the base, the walls or the top of the peritoneum.
	Hormonal disorders	Excess of estrogens

In order to prevent prolapses, be sure that breeding bulls have a well shaped pelvis area and that their dams and sisters were not affected by prolapses themselves. Do not breed heifers with bulls giving birth to bigger calves.

Be sure that mineral content in artificial milk feeding is the same as in buffalo milk.

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Be careful when making diets for replacement female calves and heifers.
Be most careful when feeding the dry-off buffalo.
Prevent the occurrence of triggering diseases.

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After the experiences presented in the workshop, the main points that need to be considered are the following:

- Scientists should investigate in the level of protein and energy of the ration and on the effect of these components on the level of buffalo milk production
- We must take into consideration the genetic make up of the animal: genetic and feeding effects can be in fact confused if animals are not fed optimum and equal diets.
- Meat quantity and quality should also be considered, body conformation scores and measurement can be useful parameters for estimating these traits. Results of trials effected in our Institute indicate that buffalo meat quality is good up to 2 years age. In Egypt, buffalo young calf is used to produce baby veal which is reared on whole milk only and the price of which is very high. Meat therefore is sold to five stars hotels.

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As regards to the comparison of feed passage rate and digestive capacity in cattle and buffaloes, we must consider that the knowledge on the nutrition of sheep, goats and buffalo is less complete than that of cattle. Less money is available and fewer researchers work on these economically minor species compared to cattle. The improvement of buffalo, sheep and goats productivity requires an accurate quantitative prediction of feed utilization and animals' responses. Considering the limited resources available for research on these minor species, my approach has been to try to define the similarities and the differences existing between cattle, on one side, and buffalo, sheep, and goats on the other side.

In those physiological or technical aspects in which

I find similarities, I transfer the knowledge available for cattle to these minor species. Where I find differences, I try to understand their biological bases to adapt, with the appropriate corrections, the knowledge on cattle to minor species. Only when the differences between cattle and the minor species are such that the transfer or the adaptation of knowledge is impossible, I carry appropriate experiments.

In light of this approach, I compared passage rate, rumen volume, and fiber digestibility in cattle and in buffaloes by using 9 scientific publications in which cattle and buffaloes were fed the same diet (22 dietary comparisons in total).

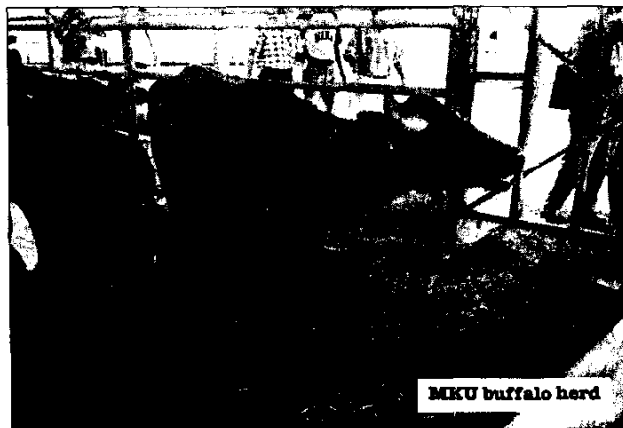
The results of this comparison showed that: when fed the same diet, forage intake was sometimes higher in cattle and sometimes higher in buffaloes, regardless the fiber content of the forages;

forage passage rate was more often higher in buffaloes than in cattle and, as consequence, fiber digestibility was more often higher in cattle than in buffaloes;

when forage passage rate was divided by the level of intake (kg of DM eaten per 100 kg of body weight), the ratio was always higher in buffaloes than in cattle, implying that at the same level of intake the passage rate tends to be higher in buffaloes than in cattle.

Other important differences reported by some of the publications were that buffaloes had higher rumination activity and, as result, smaller ruminal feed particle size than cattle. The latter difference suggests that the higher feed passage rate in buffaloes than in cattle, at similar forage (and NDF) levels of intake, is due to the smaller ruminal feed particle size of buffaloes. It is well known that passage rate increases as feed particle size decreases.

In conclusion, the comparison of buffaloes and cattle fed the same diet suggests that the well known ability of buffaloes of exploiting coarse forages is not the result of higher ruminal digestive capacity. Other factors, such as higher nitrogen recycling or lower maintenance requirements may explain buffaloes superiority on coarse diets.



Conclusion and recommendations from the F.A.O.
WORKSHOP ON EXPERIENCES ON BUFFALO NUTRITION

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The talks of the Italian, Israeli and Egyptian farmers and of Prof. Sekerden highlighted two main situations in buffalo production systems:

- a) - Areas and farms with intensive feeding and utilization of high levels of concentrates, resulting in high levels of milk production;
- b) - Areas and farms with extensive production systems, with animals mostly fed on marshlands or low quality roughages or by-products and little or no supplementation with concentrates, resulting in low levels of milk production and low inputs of technology;

In the first case the goal is to maximize milk production, because the ratios between buffalo milk price and feeding cost and between buffalo milk price and cow milk price are higher than two. In the second case the goal is to use local resources at low cost, because the above mentioned ratios are lower than 1.5.

Despite these differences, both types of buffalo production systems could take advantage of improvements on the knowledge on buffalo digestive capacity, metabolism and on the relationships between nutrition and health. Considering the limited resources available for research on buffaloes, we decided to focus on those aspects in which buffalo and cattle are substantially different. For the other aspects we suggest to use the knowledge we have on other ruminant species, especially on cattle.

The aspects that appear to have the lowest priority at the moment are:

- 1) - rumen microbiology and biochemistry (energy and protein fermentation pathways),
- 2) - feed energy and protein evaluation (digestibility; carbohydrate and protein chemical fractioning);
- 3) - energy and protein requirements of the animals.

The aspects that require more attention, which were intensively discussed during the workshop, as well as the results of the discussion are reported below.

1. DIGESTIVE TRACT FUNCTION.

The mechanisms that allow buffaloes to exploit low

quality feeds, often refused by cattle, need to be explored.

We found that the most important factor to understand the peculiarity of buffalo in respect to other ruminants is the feed passage rate. The research presented in the workshop suggested possible differences in passage rate (Kp) between buffaloes and other ruminant species. For this reason, rumen Kp prediction in buffaloes should be studied more deeply. On this regard, the most important variables that need to be explored are animal factors (age, genetic merit, lactation stage and chewing activity) and external factors (**level of intake, dietary fiber content**, particle size, feeding strategy, feed processing, and environmental factors such as temperature).

Another important aspect that may differentiate buffaloes from other ruminant species regards nitrogen recycling, which seems to be higher in buffaloes than in other ruminants, especially with low quality diets. This could be the result of the higher rumination and saliva production of buffalo compared to other ruminants.

Other factors that allow buffaloes to exploit low quality feeds could be lower maintenance requirements and higher rumen digestibility due to factors other than passage rate (e.g. higher rumination activity, different microbial activity)

Regardless possible differences between buffaloes and other ruminants, we suggest to consider the opportunity of using for this species the modern available tools (such as the Cornell Net Carbohydrate and Protein System), originally developed for cattle, that allow a proper synchronization of energy and protein fermentation in the rumen and that maximize bacterial activity and minimize energy and protein wastage.

2. METABOLISM (ENDOCRINOLOGIC AND METABOLIC ASPECTS).

The research presented suggested differences between buffaloes and cattle regarding some hormonal controls that affect nutrient partitioning between body reserves and mammary gland (e.g. a decrease in energy intake causes higher decrease in milk yield in buffalo than in high producing dairy cows; in opposite to what happens in dairy cows, high levels of concentrate seem to determine higher fat concentration in milk; often there is higher amino acids utilization for gluconeogenesis than in cows).

As already done for cattle, the relationships among metabolism and age, genetic merit, lactation stage, feeding strategy, and environment should be explored.

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3. APPLIED NUTRITIONAL PROBLEMS.

It is necessary to use the knowledge on digestive and metabolic functions to predict buffalo performances (milk yield and quality, growth rate and meat quality). The performances of the animals should be monitored using tools such as BCS, health status, dry matter intake, and fertility. The aspects that should be analyzed are listed below for different animal categories.

GROWING ANIMALS

- a) for fattening animals (meat production) research should be carried out to improve meat quality and increase consumer acceptability;
- b) for heifers research should focus on energy and protein balance and utilization to obtain optimal growth rates and mammary gland development.

DRY DAIRY BUFFALOES

There is a clear lack of knowledge on energy and protein balance and utilization efficiency, mineral balance (especially Ca and P) and feeding strategies (e.g. steaming up) to prepare animals to lactation and to minimize health problems, especially prolapses of uterus and vagina.

LACTATING BUFFALOES

Priority should be given in defining feeding strategies able to maximize milk peak yield and persistency, in light of the problems mentioned before regarding the peculiarity of buffalo metabolism.

PARASITES PROBLEM

Considering the worldwide diffusion of internal and external parasites, their effects on the utilization of nutrients by buffaloes should be explored and quantified.

The participants at the field trip



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