FEEDING RIVERINE BUFFALOES FOR MILK/DUAL PURPOSE PRODUCTION

by

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INTRODUCTION

Of the world total of about 138 million buffaloes (Jasiorowski, 1988), riverine buffaloes represent 70% with the concentration in India (76 M) Pakistan (14 M) and Egypt (2.4 M). Jasiorowski (1988) and Mudgal (1988) point out an increase of about 11.2% in the number of the river buffalo type between 1983 and 1986, indicating an increasing awareness by farmers of the importance of the animal in their economic life and as an integral part of the farming system.

Proportions of buffalo milk and meat respectively in the world total production increased from 5.5% and 0.8% in 1976 to 6.8% and 1.0% in 1986. In Asia and the Pacific countries, total milk production from buffaloes in 1985 was about 31 million tonnes (91% of total) (Mudgal, 1988) with India alone producing about 22 million tonnes. Corresponding values for meat production are 1 million (80%) and 0.3 million tonnes in Pakistan. In Egypt, buffaloes produce 65-70% and 45-50% of total milk and meat respectively, (Central Agency for Statistics, 1986).

For many decades however, research for development was slow, scattered and uncoordinated and failed to achieved meaningful results. Consequently, it was believed that the low fertility and low production levels are inherent traits of the species. Fortunately, coordinated research in the past 25 years in Egypt, India, Japan and Taiwan supported the theory that low production levels are related to poor management and to poor nutrition in particular.

The main aims of this paper are:

a) to compare the characteristics of the digestive physiology and nutrition of the buffalo and the cow, and

b) to describe an improved feeding/management package for enhancing the production of milk and meat.

COMPARATIVE DIGESTION AND NUTRITION OF RIVERINE BUFFALOES AND CATTLE

There is no difference in the digestive tract between the buffalo and the cow, the four-pouched stomach and the rest of the gastrointestinal tract being the same in both species. The rumen in cows and buffaloes is well adapted to utilize the cellulosic matter and the main fermentative compartment proceeds the main site of digestion, allowing the maximal use of fermentation products.
From a functional point of view however, there might be a difference between the riverine buffalo and the cow in ability to digest poor quality roughage, e.g. rice straw (Ranjhan, 1988). The reason for this difference, reported from feeding trials, is not quite understood although differences in rumen bacterial growth rate between species were reported by Zaki El-Din et al. (1985) as a result of feeding the same roughage diet with or without added urea and/or molasses. The ability of the buffalo to consume more DM from rice straw than the cow could further explain the difference in digestion (Devendra 1987).

In Egypt, research on comparative digestibility and efficiency of feed utilisation between buffaloes and cows is limited. It has been reported that local buffaloes and cows digest concentrates and good quality roughages, like berseem hay, equally well. With poor quality roughages like rice straw however, the buffalo excelled the cow in digesting DM and CF (El-Ashry 1988; Saied Mahmoud, personal communication). With regard to the efficiency of feed utilisation for meat production, the buffalo steer calves produced more meat per unit of feed intake than either local steers of native or Friesian breeds (El-Ashry et al., 1975).

Research reports from India indicated the superiority of riverine buffaloes over cows in lignin turnover and that was due to animal size being responsible for greater digestion in buffaloes than cows (Mudgal, 1988). The results also show that TDN output/input ratio varied from 6 to 30% and protein output/input ration from 5 to 40%, indicating that buffaloes fed on straw and a grain-based diet were more efficient than cows. With regard to comparative utilization of energy for milk production, it has clearly been shown that maintenance and production requirements were higher in Murrah buffaloes than in Brown Swiss x Sahiwal cows, indicating that cows were more efficient in utilizing metabolizable energy for milk production than buffaloes (Mudgal, 1988).

FEEDING/MANAGEMENT OF RIVERINE BUFFALOES

Feeding from birth to weaning

A project was started in 1973 and continues at Ain Shams University, Faculty of Agriculture to study the effect of improved feeding management on the performance of buffalo calves during pre- and post-weaning phases of growth. The accumulated results from this project (El-Bassioni, 1983; El-Serafy et al., 1982) and from other research stations in Egypt were summarized by El-Serafy and El-Ashry (1989).

In general it was concluded that, to achieve maximum benefits from rearing calves on milk replacers, a package of management is required, namely to feed restricted amounts of replacers (4 kg liquid
divided into two meals), to have fresh water available, to avoid using antibiotics in milk replacers, to introduce a mash starter from two weeks, to offer good quality berseem hay leaves *ad libitum* and to rear calves in a well ventilated barn, always using a dry bed of rice straw.

Feeding buffalo males for growth

From weaning to about 150 kg body weight, male calves require special attention in formulating rations to promote maximum tissue growth. A highly digestible pelleted starter (70 to 75% TDN and 15 to 17% DP) is essentially required to achieve about 0.7-0.8 kg ADG (EL-Ashry et al., 1981). The ratio concentrate to roughage ranges between 50:60 or 60:40 on a DM basis, with good quality berseem hay making up at least half of the roughage (El-Koussy 1981). Comparable ADG values for buffalo calves at the same age/weight reported in the fifties and sixties were much lower (400-600 g: Ragab et al., 1966).

Different roughages fed to male calves during growth have shown the superior effect of rice straw, compared to wheat or bean straws (Afifi, 1977). Their results showed that calves required 4.42, 4.68 and 4.80 kg feed DM to produce one kilogram gain.

Rice straw contains more ligno-cellulose bonds and ash than wheat or bean straws (Van Soest, 1987, personal communication) and its TDN value is less than the other two straws (Abou Raya, 1967). A possible explanation for better efficiency of utilization by buffalo calves is that the rumen cellulolytic micro-organisms in buffaloes are more capable of breaking these bonds, making hydrolyzed glucose units available for VFA production (Abou Akkada and El-Shazly, 1966; Zaki Eldin et al., 1985)

Feeding for fattening of buffalo males

Two fattening practices of male buffalo calves are recognize in Egypt:

a) Fattening from 200 to 350 kg, over a short fattening period of about 4 months, and

b) Fattening from 250 to about 500 kg over a relatively longer period of 10 to 11 months (called bitello).

The first practice produces relatively juicier meat but the second is the main practice because of its high dressing yields.

The overall ADG during fattening is usually between 800 to 900 g/d, depending on the level of concentrates, being higher with concentrates level in ration over 50% of the diet in which the main roughage as rice straw (Afifi, 1977). In feedlot fattening operations (Shehata et al., 1973), ADG was 800 to 1000 g when the concentrate portion of the ration was 75% and when 1 kg concentrates was offered for each 50 kg live body weight.
Carcass measurements

Although in fattening trials different ratios of concentrates to roughages were used, the dressing percentage ranged from 50 to 60%, depending on the weight at slaughter, being higher than 52% at slaughter weights above 400 kg. Also, high dressing percentages, meat:bone ratios and carcass-fat are usually associated with high levels of concentrates (Table 1).

Table (1) Dressing and bone-less meat percentages of buffalo calves slaughtered at different weight categories.

<table>
<thead>
<tr>
<th>Feeding groups’</th>
<th>Overall average</th>
</tr>
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<tbody>
<tr>
<td>I II III IV V</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td></td>
</tr>
<tr>
<td>Dressing %</td>
<td>53.3 53.5 57.4 50.2 47.1 52.3</td>
</tr>
<tr>
<td>Boneless meat %</td>
<td>83.2 81.7 82.8 79.9 81.7 81.8</td>
</tr>
</tbody>
</table>

Calves slaughtered at 300 kg

Dressing % 57.1 54.7 54.1 54.0 57.6 55.5
Boneless meat % 81.2 82.5 82.7 81.9 83.4 82.3

Calves slaughtered at 500 kg

Dressing % 59.8 60.2 59.7 60.6 54.4 59.9
Boneless meat % 79.3 82.1 84.0 83.0 78.2 81.3

Feeding groups I to V corresponds to levels of Napier grass of 5, 10, 15, 20 and 25%, respectively on DM basis.
In conclusion, the recommended feeding regime for growing male buffalo calves from 90 to 200 kg live body weight consists of a 50:50 concentrate to roughage ratio on a DM basis. The concentrate portion should be highly digestible pellets containing 65-70% TDN and at least 15% DP, while the roughage portion is made up of 2-cut berseem hay and rice straw (50:50 ratio). Intake in this growing period was calculated as 3% of body weight. For fattening purposes, the rations should contain between 65-80% concentrates.

**Feeding of growing/pregnant heifers**

Raising of a good buffalo heifer is a prerequisite for achieving a high-yielding buffalo cow. The characteristics of a good heifer in Egypt (El-Ashry, 1988; El-Fouly and Afifi, 1977) are to weigh 350-370 kg at 16-18 months of age at which the heifer reaches sexual maturity, exhibit regular oestrus cycles and to be ready for mating in order to deliver her first calf at 27-28 month of age (460 to 480 kg weight).

From weaning to about 180 kg, heifers require the same special attention as was described in feeding males. About 2 kg/100 kg body weight of the pellet starter are required to achieve about 700 g ADG. A typical ration during this growing phase (average weight 125 kg) is composed of 2.5 kg of starter concentrate and 1 kg each of berseem hay and rice straw. Calculated intakes of nutrients in this ration are as follows: DM 4.1 kg, DM % of body weight 3.2, TDN 2.5 kg, DP 0.455 kg, ME/kg W\(^{0.75}\) 229 kcal. Mudgal (1988) reported ME for maintaining buffalo heifers as 188 kcal/kg W\(^{0.75}\), while Arora (1988) reported a value to 206 kcal/kg W\(^{0.75}\) for maintenance and growth.

It has been shown that late-pregnant buffalo heifers need an extra 0.5 kg corn per day, in addition to the previously mentioned requirements. Aboul Ela (1988) concluded that resumption of cyclic activity post-partum in buffalo cows is influenced by feeding in late pregnancy and early lactation.

**Feeding lactating buffalo cows**

On a DM basis, buffalo's milk contains about 41% of total ingredients as fat and is thus characterized by a relatively high energy content, which should be carefully considered in the ration fed. A standard water buffalo cow weighing 500 kg, in her 3rd lactation, producing 7 kg/d milk for 300 days with average 7% fat requires 2 kg TDN and 400 g DP for maintenance plus 750 g TDN and 80 g DP per kg milk produced.

In Egypt, different concentrates and roughage ingredients are used to make up rations for lactating buffalo cows. Common concentrates which have been examined include cereal grains, cane molasses, cotton-seed cake, horse bean, soybean, linseed meal and sun-
flower seed. Common roughages include berseem hay; rice, wheat and barley straw; wheat and rice brans; rice hulls and water hyacinth hay or silage. The main green forage in winter is berseem (*Trifolium alexandrinum*) and its hay in summer.

In practice, a mixture of concentrates (60% TDN, 14% DP) is prepared in a cube form and comprizes yellow corn 23-25%, undecorticated cotton seed cakes 25-40%, wheat bran 10-15%, rice bran 10-15%, sugar cane molasses 3-6% and common salt plus lime stone 1.5%-2.5%. In winter, the feeding system of dairy buffaloes depends on green berseem and rice straw for dry, non-pregnant or early-pregnant buffalo cows. In summer, on the other hand, berseem hay replaces green berseem and green maize (darawa) is offered as a source of available vitamins (El-Ashry, 1988).

Several research trials were conducted to evaluate different roughages and concentrates for lactating buffalo cows. The ultimate goal of these trials was to introduce cheaper feed ingredients at maximum rate in the rations. The relatively cheaper roughages, mechanically-treated non-classical roughages like cotton stalks and corn cobs, were sprayed with sugar cane molasses to improve their utilization by lactating buffalo cows (El-Serafy, 1968). Although hazardous and expensive, NaOH treatment significantly improved the utilisation by lactating buffalo cows of poor quality roughages (rice and wheat straws and cotton stalks) (Abou Raya, 1967). The level of roughages in rations for lactating buffaloes has been generally accepted as 50% of total DM.

Research on the use of cheaper sources of nitrogen indicated that the urea can replace up to 50% of total nitrogen of rations for lactating buffaloes with no adverse effect on milk or fat yield (Khattab et al., 1981).

The level of concentrates in rations for milk production from buffaloes has a significant effect on milk and fat yields and the efficiency of dietary energy utilization (El-Ashry et al., 1975; the results are summarized in Table 2. Their data indicate that the efficiency of dietary utilization for milk production was significantly greater in winter than in summer. The level of 50% concentrates was more efficiently utilized for milk energy or protein but more than 60% concentrates in the ration reduced milk fat.

When intake is equal, the efficiency of utilization of the above feed ingredients for milk production is not different within a class of feedstuff. Mudgal (1988) discussed several factors affecting feed requirements and utilisation by buffalo cows and indicated that in dry subtropic regions temperature, shade, water requirement and disease are most important factors.
Table 2 Effect of level of concentrate and season on efficiency of dietary energy utilisation for milk production

<table>
<thead>
<tr>
<th>Feeding season</th>
<th>Concentrate level %</th>
<th>Net efficiency of use of dietary energy %</th>
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<tbody>
<tr>
<td>Winter</td>
<td>0</td>
<td>65.2</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>68.0</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>67.6</td>
</tr>
<tr>
<td>Summer</td>
<td>0</td>
<td>60.2</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>60.9</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>62.0</td>
</tr>
</tbody>
</table>

Feeding bulls for production and draught

Feeding riverine buffalo bulls for production and draught is not common practice in Egypt. For doing some light work and for exercise, 5-6 year old breeding bulls are used to operate waterwheels ("sakia") for irrigation. The share of buffaloes in farm work was calculated as less than 8% of annual working hours regardless of farm size (Soliman, 1985). Requirements of breeding/draft bulls were calculated by Ranjhan & Pathak (1983).

OTHER MANAGEMENT ASPECTS IN REARING RIVERINE BUFFALOES

The following practices are used in improved management systems in Egypt:
- supplementary minerals and vitamins when animals are consuming dry feeds (summer feeding),
- spraying animals with water twice/d in summer (June-August),
- tethering fattened calves or lactating buffaloes and loose-housing for heifers,
- use of locally available materials for making sheds (the roof for sheds is made of rice straw sandwiched between two light-wood-framed bamboo mats),
- detecting oestrus with the bull twice daily,
- artificial insemination (using fresh semen) 10-12 hrs from the first natural mating,
- using mechanical milking machines, and
- regular (weekly) veterinary checks and assistance of the veterinarian in heifers delivering their first calf.
FUTURE OUTLOOK

Research should concentrate on biotechnology aspects such as super ovulation, embryo transfer, hormonal treatments to increase milk production and manipulation of rumen micro-organisms for better utilisation of ligno-cellulosic bonds in high-fibre-containing roughages. With increasing demand for milk and the noticeable decrease in the area of forage every year, there is an urgent need for cross breeding, possibly with a smaller but more productive strain. Otherwise buffaloes could loose ground to the efficient crossbreds from exotic cattle.

REFERENCES


