

Characterisation of the livestock production system and the potential of feed-based interventions for improving livestock productivity in Monomothpur and Khairpara village, in the Dinajpur district of northern Bangladesh, September 2010

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The Feed Assessment Tool (FEAST) is a systematic method to assess local feed resource availability and use. It helps in the design of intervention strategies aiming to optimize feed utilization and animal production. More information and the manual can be obtained at www.ilri.org/feast

FEAST is a tool in constant development and improvement. Feedback is welcome and should be directed to feast@cgiar.org. The International Livestock Research Institute (ILRI) is not responsible for the quality and validity of results obtained using the FEAST methodology.

1. Background

The Feed Assessment Tool (FEAST) was used to characterize the livestock production system with a particular focus on the feed-related aspects of Monomothpur and Khairpara villages in the Dinajpur district of northern Bangladesh. The FEAST is a simple questionnaire that utilises a combination of informal group discussions and structured interviews with key farmer informants to rapidly assess on-farm feed availability in a smallholder context. The study was conducted by staff members from the International Livestock Research Institute (ILRI) in partnership with the local staff from the international Non-Government Organisation (NGO), CARE. The aim of the study was to; firstly gain an understanding of the overall production system with a particular focus on the livestock feeding strategies employed by farmers, and secondly, identify key areas of the feeding strategy that could be altered to improve livestock productivity.

2. Materials and Methods

2.1. Study site

The villages of Monomothpur (GPS co-ordinate N25.65601, E088.86491) and Khairpara (GPS location N25.62788, E088.97379) in the Dinajpur district of northern Bangladesh were selected for the study. These areas were deliberately selected by staff from ILRI and CARE as the sites will be part of future Cereal Systems Initiative of South Asia (CSISA) projects in Bangladesh.

2.2. Sampling method

2.2.1. *Selection of villages*

The selection of villages was conducted by CARE. Monomothpur village and Khairpara village within the Dinajpur district were selected. These areas participate in CARE's Strengthening the Dairy Value Chain (SDVC) project. Additional selection criteria stipulated by ILRI included; that the majority of households raise livestock (namely dairy animals) and participate in cropping activities.

2.2.2. *Selection of participants for the group discussion*

CARE selected participants from the women's groups that participate in their SDVC project. Participants were selected that represented the range of wealth statuses in the villages, kept dairy animals and participated in cropping. Twenty four farmers (20 women and 4 men) were selected in Monomothpur. Twenty six farmers (18 women and 8 men) were selected in Khairpara.

2.2.3. Selection of key informant farmers

Three farmers were selected from the participants of the group discussion in Monomothpur and Khairpara to carry out a further individual questionnaire. These key informant farmers were selected to represent the 3 main categories of wealth in their respective areas. Landholding was used to determine wealth. The three categories of wealth were below average landholding, average landholding, and above average landholding. The cut-off point between the various wealth categories were determined by the farmers during the group discussions. Dairy cattle holdings were also considered. Farmers selected as key informants had to have at least the average number of dairy cattle. The average number was determined by the group.

2.3. Survey structure and format

The questionnaire was developed by ILRI staff. Trials of the questionnaire had previously been undertaken in east Africa, India and Nepal. The Monomothpur trial was conducted on the 20th of September, 2010. The Khairpara trial was conducted on the 21st of September, 2010. The questionnaire was conducted in two sections. The first section was conducted as a 1-2 hour informal group discussion consisting of open-ended questions in a semi-structured format. Discussions were led by CARE and ILRI staff. Discussion topics included; average farm sizes, average household sizes, rainfall pattern, labour requirements, livestock holdings, crops grown in the area, purchased feeds, livestock health, livestock reproduction, livestock management, marketing of milk products, current problems affecting livestock productivity and what farmers view as potential solutions to these problems. The responses provided an overview of the production system with a particular focus on dairy production.

The second section of the questionnaire was a 30 min- 1hour long structured interview. Staff from CARE conducted the interviews with the 3 informant farmers from each village. Farmers answered the questionnaires individually. Topics included; livestock holdings, livelihood activities, milk prices, milk yields, crops grown, ration formulation and farmer perceptions of feed quality. This information provided detail about on-farm feeding strategies and nutrient availability.

2.4. Data analysis

Questionnaire responses were transcribed into Microsoft excel by ILRI staff. Narrative responses collected during the group discussions were examined and reported. Responses collected during the key informant interviews were used to calculate approximate average values on a per household basis for key variables related to feeding such as; the composition of the diet, Metabolizable Energy (ME) availability in the diet, Crude Protein (CP) availability in the diet, income generated from milk sales, and estimates of livestock productivity. Calculation of these variables was based on the quantities of purchased feed stated by farmers and the level of on-farm crop production. Standard grain yield to residue ratios (Brown, 2003) were used to estimate on-farm crop residue production. Standard Dry Matter (DM), ME and CP values for feed materials were obtained from

NRC (2001). Farmer weight estimates of dietary ingredients were considered inaccurate and were not used where possible.

3. Results

3.1. Monomothpur

3.1.1. Overview of the production system

The area is dominated by smallholder producers who utilise approximately 0.27ha of irrigated land per household. Households are usually composed of around 5 members. Two distinct seasons occur, Aman which occurs from mid-June to the end of December and Boro which occurs from early January till early June. The majority of the rains fall during late May through to July. Rice (*Oryza sativa*) is the main crop grown throughout the year. During Aman, Aman rice is grown whilst Boro rice is grown in Boro. Other crops such as; maize (*Zea mays*), potatoes (*Solanum tuberosum*), jute (*Corchorus spp.*), mustard (*Brassica rapa*), and a range of vegetables are also grown as shown in Figure 1. No fodder crops are grown in the area. Most households hire labour from outside the area as 50% of young people leave for work and education. Labour is usually hired during; December, June and July for planting and April, May, October and November for harvesting. Male labourers are hired for 100-150Tk (USD\$1.42 –USD\$2.13) per day and female labourers are hired for 70-100Tk (USD\$0.99-USD\$1.42) per day. Local dairy cows, poultry and goats are the most commonly kept livestock species. Some households also keep fattening cattle. Agriculture is the main contributor to household income, contributing approximately 65% of all household income. Off-farm employment, livestock and off-farm businesses also contribute to household income as shown in Figure 2.

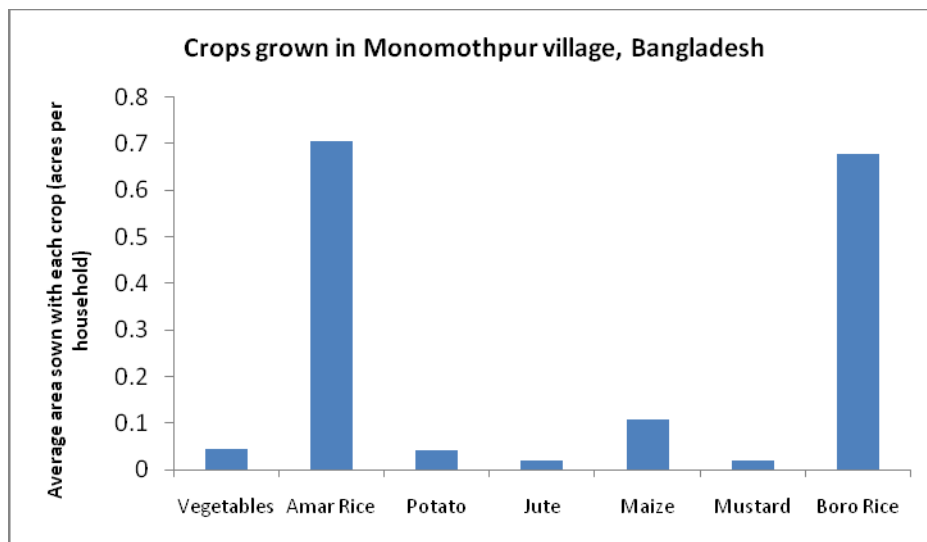


Figure 1: The average area of land per household sown to the major crops in Monomothpur village, Bangladesh.

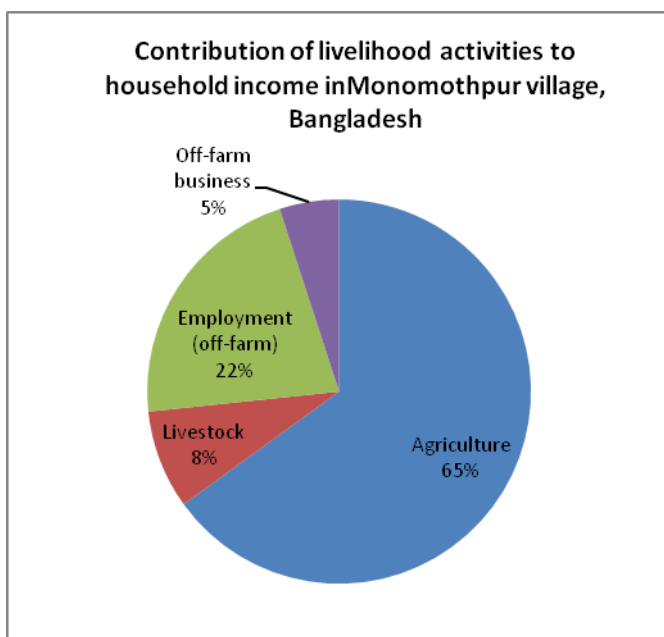


Figure 2: The average contribution (as a percentage) made by the various livelihood activities to total household income in Monomothpur village, Bangladesh.

3.1.2. The livestock system

Every household in the area owns at least two local dairy cows. On average, each cow generally produces 200 litres of milk per year. The milk is usually sold for 18-25Tk (USD\$0.26-USD\$0.35) per litre. The price received for milk tends to be slightly higher than average during November, December and January when rainfall is low. Local dairy cows in good condition (after second calf) are purchased for 30000Tk (USD\$425.68). Once a cow is no longer capable of producing adequate quantities of milk, she is sold after a short period of fattening. At present, approximately 6% of households are fattening at least 2 old dairy cows and/or young males for slaughter. Improved dairy cows are uncommon in the area. Only 4% of households keep improved dairy cows. These households usually own one such animal. The majority of households (60%) keep at least 2 goats. These animals are sold for slaughter at irregular intervals. Every household also keeps at least 5 chickens and/or ducks for egg production and to satisfy household meat requirements. The distribution of livestock holdings in Tropical Livestock Units (TLUs) is shown in Figure 3.

Dairy animals are stall-fed in a purpose built, open-walled structure throughout most of the year. The structures are usually non-concrete made from locally available materials, sometimes with the addition of corrugated iron, asbestos or tiles for roofing. Households with larger land holdings may allow their cows to graze household fallow areas during daylight hours from December to February. During cold periods a jute bag will be used as a blanket to cover the animals and keep them warm. During rainy periods (primarily June and July), 90% of households light a mosquito coil in close proximity to the animals to keep mosquitoes away.

Veterinary services are available when required by farmers. An animal health clinic is located within the area, approximately 1km from the furthest away households. Additionally, there is also a mobile service. In the event that an animal cannot walk to the clinic, the farmers can call the veterinarian to come to their household. The majority of households do not worm or vaccinate their livestock as farmers are unaware of the importance of these procedures.

Very few households in the area use Artificial Insemination (AI). AI was only introduced recently by CARE as part of the SDVC project. At present, only 1% of households use this service. AI is usually carried out for 200Tk (USD\$2.84) (including service fee). Repeat AI services are also 200Tk (USD\$2.84). Natural matings are the preferred mode of reproduction costing 80Tk (USD\$1.13) per service. If a repeat service is required it is available at a reduced price of 50Tk (USD\$0.71). Farmers are not in favour of crossing their local cows with improved breeds. They believe that a crossbred animal is of poorer quality as it has none of the advantages of either breed involved in the cross.

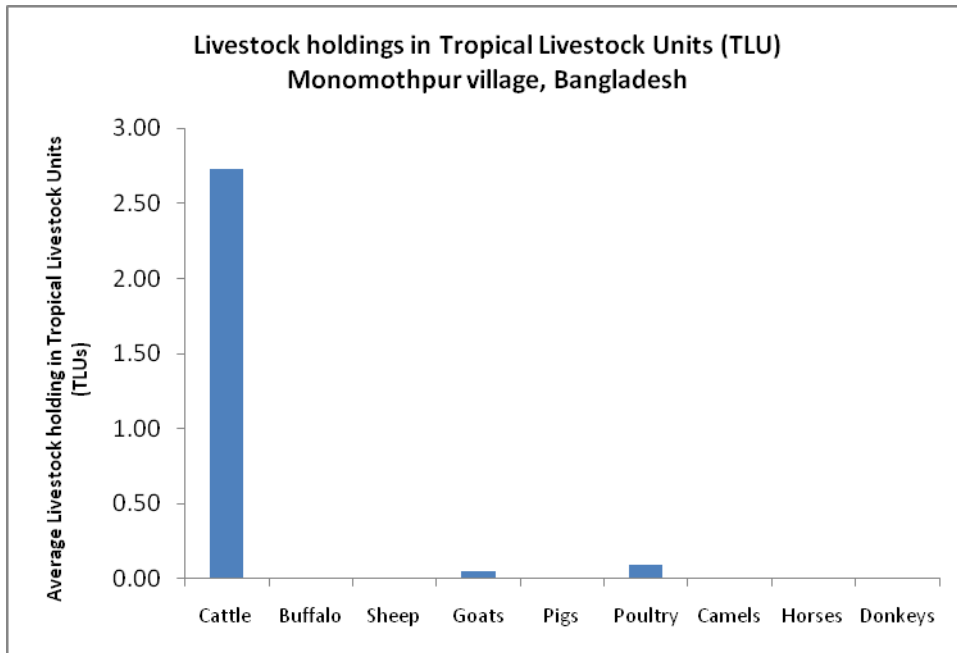


Figure 3: The average Tropical Livestock Units (TLU) holdings per household in Monomothpur village, Bangladesh.

3.1.3. Feed availability throughout the year

Rice straw is the main component in the diet of dairy animals in the area, contributing approximately 65% (as fed) as shown in Figure 4. Rice straw is also the major contributor to dietary ME and CP, contributing 81% and 59% respectively. The diet does not vary significantly between the seasons. Farmers in this area primarily feed the straw as a long fibre and do not make any attempts to process or improve the quality of this material. Many farmers are aware that chopping the straw is one method that could be used to improve the quality of the straw, however, none of the farmers attempt to chop the material due to time and labour constraints. Farmers do not feed all the rice straw that is currently being produced on-farm. On average each household only feeds 75% of the Aman rice straw and 40% of the Boro rice straw. The remaining straw is either burnt, sold, used as roof thatching or left to stand in the paddock. Farmers perceive Aman rice straw to be a higher quality feed and prefer to keep this material for feed purposes when compared to Boro rice straw. The straw is usually stored in an uncovered heaped pile in close proximity to the cattle until required for feeding. Those farmers that grow maize do not feed or sell the stover. It is usually left in the paddock.

Open grazing and green fodder are also important components in the diet. Grazing contributes 20% and green fodder 15% of the total diet. Green fodder is usually composed of naturally occurring grasses that have been collected and brought back to the animal. Grasses are generally collected

from paddy ridges, roadsides and weeds from cropping areas. Grazing and green fodder also make significant contributions to the ME and CP content of the diet. Grazing contributes 11 % dietary ME and 24% CP. Green fodder contributes the remaining 8% ME and 17% CP.

Concentrates generally do not make significant contributions to the diet of dairy animals in this area. The only concentrate purchased in this area is the commercially available ration. This is purchased for 35Tk (USD\$0.50) per kg. Some households also feed concentrate materials that are produced on-farm such as; maize grains, cooked and broken rice. The quantities of these materials fed are minimal and do not register in comparison to the other components in the diet. Annually farmers in this area spend approximately 116Tk (USD\$1.64) or 0.02% of income received from dairying on purchased feeds. Milk sales generate approximately 4833.48Tk (USD\$68.54) per household per year.

Dietary overview of dairy animals in Monomothpur village, Bangladesh

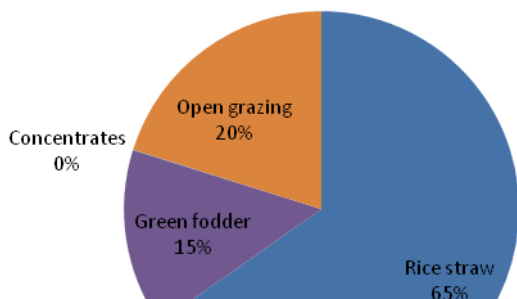


Figure 4: The contribution made by the various feed sources (as a percentage) to the total diet of dairy animals Monomothpur village, Bangladesh.

Metbolizable Energy (ME) content of the diet of dairy animals in Monomothpur village, Bangladesh

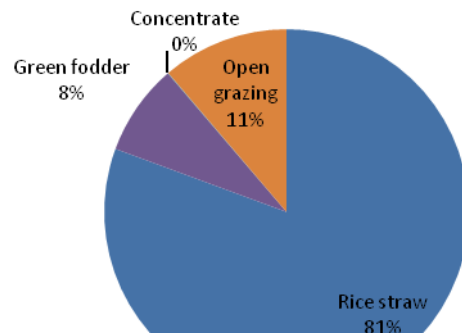


Figure 5: The contributions made by the various feed sources (as a percentage) to the Metabolizable Energy (ME) content of the diet of dairy animals in Monomothpur village, Bangladesh.

TOTAL ME CONTENT OF DIET: 40569.64MJ

Crude Protein (CP) content of the diet of dairy animals in Monomothpur village, Bangladesh

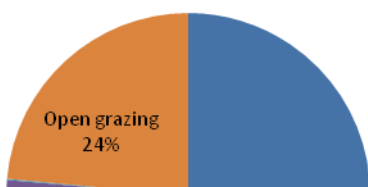


Figure 6: The contributions made by the various feedstuffs (as a percentage) to the Crude Protein (CP) content of the diet of dairy animals in Monomothpur village, Bangladesh.

3.1.4. Problems, issues and opportunities

The main the problem identified by farmers was an overall lack of knowledge about the necessary steps that need to be taken to mitigate the effects of constraints to improve the milk production capabilities of their cows. At present, the level of milk production of the local cows is very low at approximately 208.46 litres per cow per year. Farmers are unsure of specifically what information they require to improve production. However, some farmers feel that improved training in key subject areas such as; disease, reproduction and in particular nutrition, would be very beneficial as it will ensure they have a greater understanding of the diverse range of issues that are likely to be affecting their cattle. Understanding of these issues will then allow them to take the necessary steps to minimise their impact on productivity.

The poor conception rates currently being achieved with AI was the second most important problem identified by farmers. At present, those farmers that use AI have been disappointed as it requires several insemination procedures before conception is achieved. This is very costly for farmers as there is no discount offered on repeat services. This is particularly concerning as the farmers believe the failure of an AI procedure is not their fault and they are paying for the mistakes made by poorly trained AI technicians and/or poor quality semen. Thus, to alleviate this problem the farmers would like AI technicians to receive further training and would like some guarantee the semen is of high a quality and is capable of resulting in conception.

Feeding was also another constraint identified by farmers. Farmers understand that they are heavily reliant on poor quality feed materials, namely rice straw and naturally occurring grasses which are preventing their cows from producing large quantities milk. However, farmers are currently unsure what can be done to improve the quality of these feeds in a labour and cost effective manner. Therefore, farmers would like further training in regard to improving the quality of locally available feed materials.

3.2. Khairpara

3.2.1. Overview of the production system

Farms in this area utilise on average 0.49 hectares of irrigated land per household. Households generally are comprised of around 5 members. Two distinct seasons occur in this area; the rainy (Aman) which runs from the mid- June to early December and the dry (Boro) which occurs from mid-December to early June. Labour requirements are highest during the rainy season for transplantation, weeding and harvesting. During this time labour is often hired from outside the area as approximately 20% of young people leave the area for work and education. Male labourers are

usually hired for 150-200Tk (USD\$2.13-USD\$2.84) per day. Females are hired for 80-120Tk (USD\$1.14-USD\$1.17) per day. The dominant crop grown in both seasons is rice (*Oryza sativa*). During Aman, Aman rice is grown and during Boro, Boro rice is grown. Other crops such as maize (*Zea mays*), wheat (*Triticum aestivum*), potato (*Solanum tuberosum*), jute (*Corchorus spp.*), mustard (*Brassica rapa*), and a range of vegetables are also grown in much smaller quantities as shown in Figure 7. Dairy cattle, goats, and poultry are the most common livestock species kept. Draught cattle and fattening cattle are also kept by some households. The main contributors to household income are agriculture, van pulling (a bicycle with a trailer) and livestock. Agriculture contributes 69% of total income; van pulling contributes 17% and livestock the remaining 14% as shown in Figure 8.

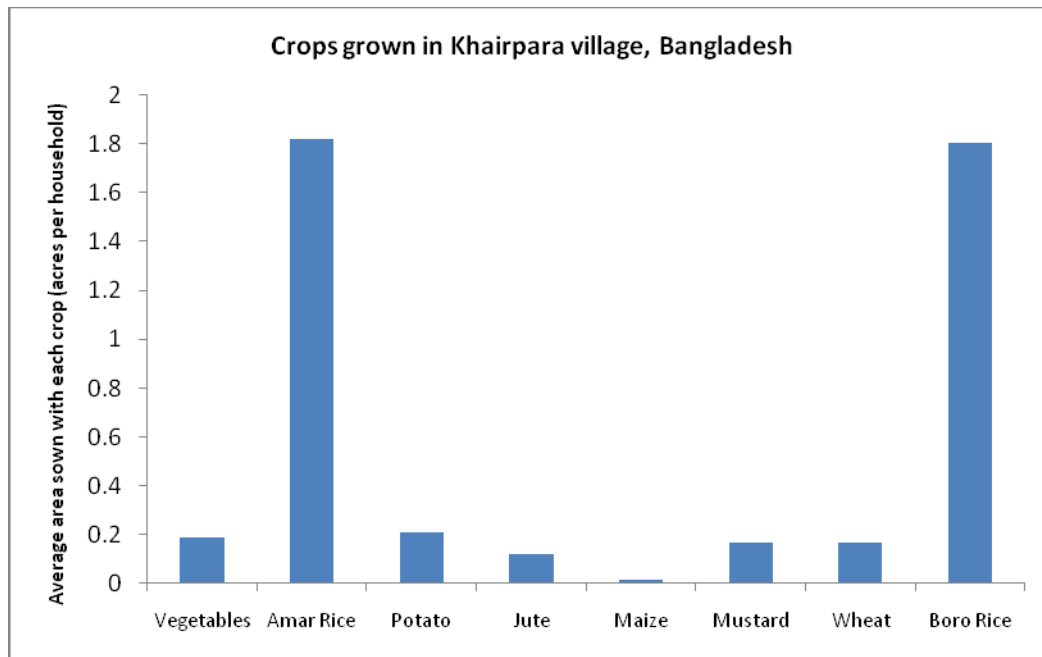


Figure 7: The average area of land per household sown to the major crops found in Khairpara village, Bangladesh.

Contribution of livelihood activities to household income in Khairpara village, Bangladesh

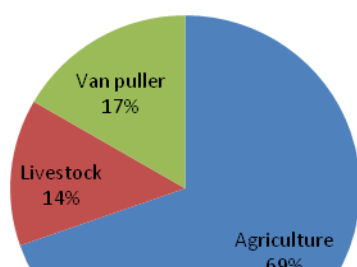


Figure 8: The average contribution (as a percentage) made by the various livelihood activities to total household income in Khairpara village, Bangladesh.

3.2.2. The livestock system

Dairy cows are kept by 91% of households in the area. Local cows dominate holdings as only 4% of households have cross-bred cows. On average, each household keeps 2 cows which each produce a total of approximately 436.64 litres of milk per year which is usually sold for 20-22Tk per litre (USD\$0.28-USD\$0.31). Milk price does not vary significantly throughout the year. There is a substantial difference in the purchase price of local and improved cows. The price of a local cow ranges from 18000-25000Tk (USD\$255.41-USD\$354.74), and the price of an improved cow will range from 35000-50000Tk (USD\$496.63-USD\$709.47). Some households also keep cattle for fattening purposes. Approximately 29% of households are currently fattening a castrated male for sale. Once the milk production capabilities of dairy cows begin to decline they will also be fattened and sold for meat. 2% of households also keep draught cattle to cultivate land and ensure cropping activities can be carried out in an effective manner. These households usually keep two castrated males for this purpose. Goats and poultry are also popular within the area. 75% of households keep at least 3 goats and all households (100%) keep at least 12 poultry animals (combination of chicken and ducks) for sale and household consumption. Average livestock holdings (in tropical livestock units) per household are shown in Figure 9.

Dairy animals are tethered and stall fed throughout most of the year. It is only during June and July that animals are allowed to graze. During periods of stall-feeding, 90% of the cattle are housed in a non-concrete structure in close proximity to the household. 10% of households keep their cattle in a room adjacent to the homestead. Approximately 50% of households provide their cattle with some form of mosquito control during rainy periods such as mosquito curtains, mosquito coils, or smoke from a fire in close proximity to the animal. During colder periods a jute bag is used to cover the animal and rice straw is laid down as bedding to keep the animals warm.

Veterinary services are available at the local veterinary clinic which is approximately 3 kilometres away. In the event that the animal cannot be taken to the clinic, they also provide a mobile service in which the vet will come and visit the household if required. Most farmers in the area vaccinate and de-worm their cattle due to the provision of this service by CARE. Similarly, CARE has made AI available to the farmers as part of their SDVC project. Semen from CARE costs 150Tk (USD\$2.13) (including service fee) for the initial procedure. Should the initial procedure fail to result in conception, the second service is only 100Tk (USD\$1.42). The introduction of AI has driven down the price of bull services. Previously, bull services cost 150Tk (USD\$2.13), however, the current price ranges from 80-100Tk (USD\$1.14-1.42).

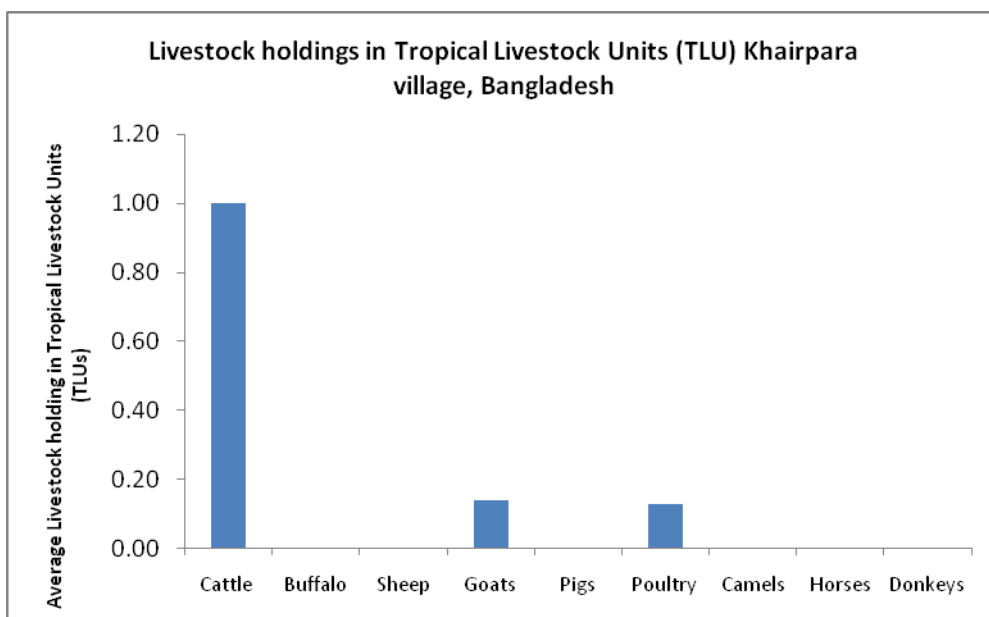


Figure 9: The average Tropical Livestock Units (TLU) holdings per household in Khairpara village, Bangladesh.

3.2.3. Feed availability throughout the year

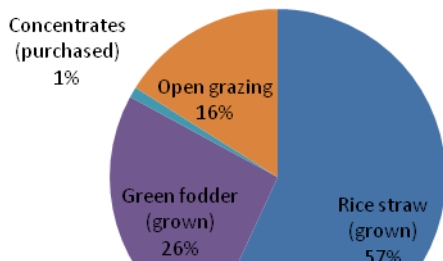
Rice straw is the largest component in the diet of dairy animals in this area, contributing 57% (as fed) as shown in Figure 10. The proportion of the various components in the diet does not vary significantly throughout the year. Rice straw is also the major contributor of dietary ME and CP contributing 73% of all dietary ME and 49% of all dietary CP as shown in Figure 11 and Figure 12. The straw material is usually fed as a whole fibre. No processing or manipulation of the material is undertaken to improve the quality of the material prior to feeding. Households generally do not use all the rice straw produced on farm. Only 66.67% of all rice straw produced is fed to livestock. The remainder (approximately 33.33%) is sold, burnt or left in the paddock. The rice straw that is collected for feeding is usually heaped into an open pile in close proximity to the animals until required for feeding.

Green fodder and grazing respectively contribute 26% and 16% to the diet of dairy animals in the area. Green fodder is material that is collected and carried back to the animals for feeding. Green fodder and grazing materials are primarily composed of naturally occurring grasses and weeds that are found on the roadsides, fence lines and paddy ridges. No households in the area participate in cropping of fodder species. Additionally, households that grow maize do not cut any of the material as green fodder or collect any of the stover for feeding. Green fodder contributes 15% of total dietary ME and 29% of CP. Grazing contributes 9% of total dietary ME and 18% of CP.

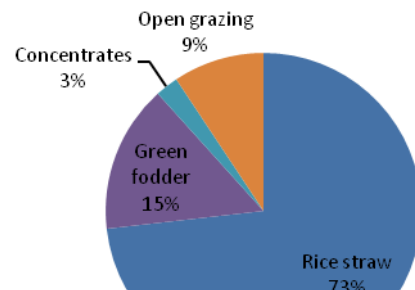
Concentrates form a small fraction of the diet contributing 1% (as fed). Concentrates include; wheat bran, mustard cake, maize grains and a commercially available ration mixture. These ingredients are usually mixed with the rice straw to improve the quality and palatability of the straw. Farmers show a preference for wheat bran as it the largest ingredient purchased as shown in Figure 13. Wheat bran and maize grains are generally purchased for 22TK/kg (USD\$0.31). Mustard cake is purchased for 30TK/kg (USD\$0.43) and the commercially mixed ration is purchased for 18TK/kg (USD\$0.26). Each household purchases 104.67kg of feed each year. On average each household spends approximately 2444TK (USD\$34.68) or 24.9% of the income generated from milk sales on purchased

feeds annually. After the purchase of feed, milk sales generate approximately 7362Tk (USD\$104.46) per household per year (excluding cost of AI, vaccinations etc.).

Dietary overview of dairy animals in Khairpara village, Bangladesh



Metabolizable Energy (ME) content of the diet of dairy animals Khairpara village, Bangladesh

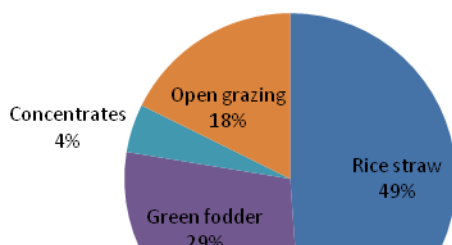


TOTAL ME CONTENT OF DIET: 45943.93MJ

Figure 10: The contribution made by the various feed sources (as a percentage) to the total diet of dairy animals in Khairpara village, Bangladesh.

Figure 11: The contributions made by the various feed sources (as a percentage) to the Metabolizable Energy (ME) content of the diet of dairy animals in Khairpara village, Bangladesh.

Crude Protein (CP) content of the diet of dairy animals in Khairpara village, Bangladesh



TOTAL CP CONTENT OF DIET: 410.87KG OF DM

Feedstuffs purchased by farmers in Khairpara village, Bangladesh

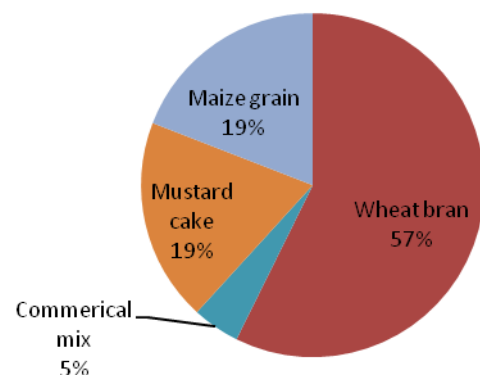


Figure 13: The average amount (as a percentage) of the various feedstuffs purchased by farmers in Khairpara village, Bangladesh.

Figure 12: The contributions made by the various feedstuffs (as a percentage) to the Crude Protein (CP) content of the diet of dairy animals in Khairpara village, Bangladesh.

3.2.4. Problems, issues and opportunities

The main problem identified by farmers was a lack of awareness about proper management of their dairy animals. Farmers feel they do not have the knowledge they require to effectively manage their livestock to improve productivity. Management encompasses a diverse knowledge base including subjects primarily pertaining to; reproduction, nutrition, and animal health. To improve their understanding of these areas farmers would like to see further training provided.

Treatment of disease was the second most important problem identified by farmers. At present, there appears to be a shortage of vaccines as farmers believe the ones they need are not available at the local animal health clinic. Though farmers are unsure which vaccines are currently unavailable, they believe by not having a full range available, it is putting their animals at risk of contracting numerous highly infectious diseases such as Haemorrhagic Septicaemia (HS) and Foot and Mouth Disease (FMD). Other diseases including mastitis and clostridial infections such as black leg and tetanus are also a concern. Farmers believe this situation can be rectified through the employment of additional veterinarians (or staff trained in veterinarian techniques) to ensure that appropriate quantities of vaccine are ordered before supplies run low.

Feeding is the third most important problem identified by farmers. Farmers feel they do not have enough knowledge about feed quality to develop an efficient feeding strategy based on what is locally available. The local grass they currently feed is considered to be of relatively low quality. However, farmers are unsure of how to make comparative decisions to evaluate which types of grasses (or other available feeds) are of higher quality and if fed would result in higher levels of milk production. To mitigate the effects of their lack of understanding in regard to feeding, farmers would like further training in nutrition and the introduction of improved fodder species that are capable of producing larger quantities of high quality feed material beyond what local grasses currently provide.

Breeding and reproductive management, with a particular reference to AI, was the least important problem identified by farmers. Farmers are unhappy with the conception rates achieved under AI. At present, a number of AI procedures are required before conception is achieved. This is a significant cost for farmers. Farmers believe this problem has arisen due to poor quality semen and poorly trained AI technicians. As a result, they would like to see AI technicians provide better quality semen and undertake further training.

4. Discussion

4.1. Potential interventions

4.1.1. Monomothpur

To mitigate the impacts of the various constraints identified by farmers it will initially be important to undertake widespread farmer training workshops. This is particularly important as it appears as though farmers have little knowledge and understanding about why their cows are not producing large quantities of milk. The identification of a general lack of knowledge in regard to three of the

main, over-arching concepts of dairy production (animal health, reproduction and nutrition) clearly demonstrates the need for additional, broad spectrum training.

The need for farmer training is further highlighted by farmer's identifying poor conception rates as a result of AI as a constraint. Farmers believe this issue is caused by poorly trained AI technicians and poor quality semen. However, poor AI conceptions rates can be caused by a number of factors. Factors can include; inability of farmers to recognise and accurately detect oestrous, poor hygiene during the AI procedure, poorly trained AI technicians, improper storage of semen, poor quality semen, high stress levels within the animal pre and post insemination and poor nutrition post insemination. These factors can all result in an AI procedure failing to result in conception. Thus, it is important farmers understand that it may not simply be the technicians fault AI is not achieving good conception rates. Training farmers about the elements of the AI procedure they control will also be important. Training of farmers to properly recognise the signs of oestrous, ensuring farmers understand the concept of stress and the best ways to ensure their cow is not subject to stressful stimuli immediately prior to, or post insemination should help to improve conception rates. Educating farmers about the importance of maintaining the cow on an appropriate plane of nutrition will also help maintain pregnancies through to parturition. Examination of the training of the AI technicians should also be considered to ensure they are appropriately trained and the poor conception rates are not due to their poor skills as suspected by farmers. Similarly, the systems employed by AI service providers should be examined to ensure that the linkages between the farmer and the technician are appropriate for ensuring the animal can be inseminated in a timely manner. Additionally, changing the pricing structure of AI services to a fixed cost per successful conception may also improve farmer's opinion of AI.

There are many options available to farmers to increase the quality of feed currently available. At present, farmers do not process the rice straw or the green fodder before feeding as manually chopping the material is time consuming and laborious. The introduction of motorised chopping equipment will allow the farmers to chop the rice straw material and green fodder prior to feeding in a labour and cost effective manner. Chopping will increase the surface area of the material, making it more easily degraded by rumen microbes which allows for larger quantities of energy to be liberated per kilogram of rice straw intake. Processing the feed in this manner will also increase the feed intake of the animals. Thus, it may also be necessary to increase the percentage of straw kept for feeding, substitute the local grasses with high yielding fodder species such as Napier grass (*Pennisetum purpureum*) and attempts should be made to collect and utilise the maize stover provided this does not adversely affect soil fertility. Additional concentrate feeds could also be purchased and mixed with existing feeds to further improve palatability, intake, and help develop a more balanced diet for the animals.

4.1.2. Khairpara

There are a number of methodologies that could be used to mitigate the impact of the problems identified by farmers in this area. As management is the main problem identified by farmers, it is unsurprising that the key components of management; animal health, nutrition and reproduction were also identified as constraints. Therefore, to improve the farmer's knowledge and mitigate the impact of management as a constraint to production, improvement in the other key areas identified by farmers must be achieved.

To improve the treatment of diseases it will be necessary to ensure that the various vaccines, medicines and treatments are available when required by farmers. It is also important that properly trained and qualified individuals capable of correctly applying the treatment are available. A lack of trained individuals and/or improper application of a treatment may limit the effectiveness of the treatment which will lead to further farmer dissatisfaction with veterinary services in the area. As farmers identified vaccination as a method of disease treatment, it may also be necessary to further educate farmers about the role of vaccination as a disease prevention technique rather than a treatment. It may also be advantageous to ensure they have a clear understanding that there is a range of vaccinations available to prevent a range of diseases. At present, it appears as though farmers are of the opinion that vaccination is a broad spectrum treatment applicable to any disease or ailment.

Development of an appropriate feeding strategy can be achieved through the use of a number of different techniques. Initially it will be important to educate farmers about the quality of the various feeds already available to ensure inefficient feeding practices are removed from the system. For example, at present each household purchases approximately 60kg of wheat bran annually for 22Tk/Kg (USD\$0.31). In the current feed market, this purchase does not represent good value for money as the higher quality commercially mixed ration can be bought at the lower price of 18Tk/kg (USD\$0.26). Steps should also be taken to improve the quality of existing feeds. At present, rice straw is the major component of the diet and provides the majority of ME and CP in the diet. However, the straw is generally fed unchopped. This represents poor utilisation of a valuable feed source. The quality of the rice straw could be improved through the introduction of simple technologies such as chopping and pulverisation. This increases the surface area of the material, making it more easily degraded by rumen microbes which allows for larger quantities of energy to be generated per kilogram of rice straw intake. Processing the feed in this manner will also increase the feed intake of the animals. Thus, it may also be necessary to decrease the quantity of straw sold, introduce high yielding fodder species and attempts should be made to collect and utilise the maize stover. Additional feeds could also be purchased and mixed with existing feeds to further improve palatability, intake, and help develop a more balanced diet for the animals.

The poor conception rates achieved with AI are likely to be caused by a number of factors including; inability of farmers to recognise and accurately detect oestrous, poor hygiene during the AI procedure, poorly trained AI technicians, improper storage of semen, poor quality semen, high stress levels within the animal pre and post insemination and poor nutrition post insemination. These factors can all result in an AI procedure failing to result in conception. The only elements of the AI procedure that farmers can control is correct identification of oestrous, and management of the animal before and after insemination. Therefore, any intervention at a farmer level should target these areas. Training of farmers to properly recognise the signs of oestrous, ensuring farmers understand the concept of stress and the best ways to ensure their cow is not subject to stressful stimuli immediately prior to, or post insemination should help to improve conception rates. Maintaining the cow on an appropriate plane of nutrition will also help to maintain pregnancy through to parturition. It may also be necessary to further examine the training of the AI technicians to ensure they are appropriately trained and the poor conception rates are not due to their poor skills. Similarly, the systems employed by AI service providers should be examined to ensure that the linkages between the farmer and the technician are appropriate for ensuring the animal can be inseminated in a timely manner.

5. Limitations of the study

The sampling design employed by the FEAST relies on a number of assumptions, particularly in regard to the selection of farmers for individual interview. The sampling methodology dictates that 3 individuals, representative of the various wealth categories within the area are selected. In this area, landholding was used to determine wealth. The responses given by these key farmers were expected to represent the situation of everyone in the area with similar landholdings. Though great care was taken during the selection process this is unlikely to be case. The farmers at the extreme ends of the landholding spectrum (that is, those with excessively large holdings, and those with excessive small holdings) are likely to be put forward as representatives by the other farmers and local staff. This could lead to overestimations and/or underestimations of variables. The use of dairy animal holdings as a second selection criterion, will help prevent the extremely poor farmers with few dairy animals from being selected. This could lead to over exaggeration of many variables if only wealthier farmers with larger dairy holdings are interviewed. Furthermore, the second selection criterion assumes that there is a positive correlation between dairy holdings and land size. Such assumptions are incorrect and the use of the second selection criterion is largely unnecessary. Ideally, the farmers selected for individual survey should be considered “average” farmers for their category of wealth. Either dairy holdings or landholding should be used as the determinant of wealth. The selection of additional farmers for interview to increase the sample size will also help to minimise the impact of possible sampling inaccuracies. However, this would make the interview process much more labour intensive.

The FEAST was developed as a simple, rapid means of assessing on-farm feed availability. This has resulted in the FEAST facing a number of trade-offs, particularly in regard to the accuracy and reliability of feed estimates. Many of the calculations made during data analysis are based on standard values. For example, estimates of crop residue availability are calculated from standard grain:residue ratios. Similarly, ME, CP and DM calculations rely on standard values. The reliance on such standard values limits the overall accuracy of estimates as these values are known to be influenced by a number of factors that can cause them to vary significantly. Collection and analysis of samples from the research sites would improve the accuracy of feed estimate calculations. However, as these values can vary between farms within a specific area, carrying out an investigation to determine site specific values would be very time consuming and costly.

The reliance on farmer estimates for calculating intake during grazing and from collected green fodder is another possible source of inaccuracy. Farmer estimates are generally imprecise as farmers do not weigh collected forages prior to feeding, and estimating intake from grazing is inherently difficult due to the number of factors that affect the intake. Additional studies and feeding trials could be undertaken to determine more accurate estimates of these variables; however, this would be very expensive and time consuming.

6. Conclusion

6.1. Monomothpur

The area is a mixed crop-livestock system which is characterized by smallholder farms. Agricultural cropping is the main income generating activity undertaken by households. Livestock are primarily integrated to produce milk for sale. Local dairy cattle, goats and poultry are the main livestock

species kept by most households. On average each dairy cow in the area produces approximately 200L of milk per year. The main feed resources relied on throughout the year are, rice straw and naturally occurring grasses which are collected and fed to the animal or grazed upon directly. The main problems identified by farmers pertain to a lack of overall knowledge and understanding about dairy production with a particular focus on key concepts such as nutrition and reproduction. To mitigate the effects of these constraints an integrated approach of further farmer training, introduction of feed processing techniques and introduction of improved fodder species should be utilised to ensure farmers have a broad understanding of dairy production and the strategies that can be employed to minimise the effects of these production constraints.

6.2. Khairpara

The area is dominated by smallholder producers who utilise approximately 0.49 hectares of irrigated land per household to produce a diverse range of crops. The most common livestock species kept are poultry, goats and cattle. These animals are primarily used to generate income from the sale of milk and meat, and to fulfil household requirements for these products. Rice straw is the main component in the diet of dairy animals throughout the year and provides the majority of dietary ME and CP. The constraints identified by farmers are related to a lack of understanding of key animal management concepts including; animal health, nutrition and reproduction. Providing farmers with training in these key areas will help mitigate the effects of these constraints. Additionally, the introduction of simple feed processing technologies, improved fodder species and strengthening of veterinarian and AI service providers will also help minimise the impacts of constraints identified by farmers.

7. Summary

7.1. Monomothpur

7.1.1. Key issues

- Lack of farmer understanding in several key areas of dairy production, namely; animal health, reproduction and nutrition.
- Poor AI conception rates
- Poor utilisation of locally available feed sources such as; rice straw and green fodder.

7.1.2. Key metrics

- Milk yield: 204.86L per cow per year
- Meat offtake: not applicable
- ME per TLU: 38.41 MJ ME per TLU per day

7.1.3. Ways forward

- Provide farmers with training on a wide range of topics related to dairy production (including animal health, reproduction and nutrition) to ensure they have a greater understanding of why their cows are not producing large quantities of milk.
- Improve farmer understanding of AI, particularly oestrous detection

- Examine training of AI technicians and the linkages used by AI service providers to access farmers to ensure insemination can occur in a timely manner.
- Increase farmer understanding of feed quality, with a particular reference to those feeds already available.
- Introduce simple feed processing technologies to improve the quality of existing feeds
- Encourage farmers to utilise a more diverse range of feeds that are being underutilised such as commercially available rations and maize stover.

7.2. Khairpara

7.2.1. Key issues

- Poor understanding amongst farmers of proper management techniques in the key areas of animal health, nutrition, and reproduction.
- Limited availability of vaccinations and veterinary treatments
- Lack of farmer knowledge about feed quality
- Low AI conception rates.

7.2.2. Key metrics

- Milk yield: 436.46L per cow per year
- Meat offtake: not applicable
- ME per TLU: 99.27 MJ ME per TLU per day

7.2.3. Ways forward

- Ensure the necessary vaccinations and trained animal health staff are available when required by farmers.
- Train farmers in the role of vaccination as a disease prevention technique rather than a broad spectrum treatment.
- Increase farmer understanding of feed quality, with a particular reference to those feeds already available.
- Introduce simple feed processing technologies (such as chopping) to improve the quality of existing feeds
- Encourage farmers to utilise a more diverse range of feeds that are being underutilised such as commercially available rations and wheat straw.
- Improve farmer understanding of AI, particularly oestrous detection
- Examine training of AI technicians and the linkages used by AI service providers to access farmers to ensure insemination can occur in a timely manner.

8. References

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