FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

FEED THE FUTURE INNOVATION LAB FOR LIVESTOCK SYSTEMS

Rapid assessment of the gaps in dairy cattle feeding, management and milk processing that constrain milk quality and quantity in Nepal

Conducted February 6-10, 2017 by

The Management Entity at the University of Florida

USAID FROM THE AMERICAN PEOPLE

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

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Acknowledgment

This report was prepared by Dr. Albert De Vries, Professor, Department of Animal Sciences, University of Florida, and Dr. Kerry Kaylegian, Research and Extension Associate, Department of Food Science, The Pennsylvania State University. They received help from Anil Sigdel, a University of Florida graduate student and a graduate of the Agriculture and Forestry University in Nepal who prepared the background information, Saskia Hendrickx, the Feed the Future Innovation Lab for Livestock Systems Project Coordinator, and Dr. Marjatta Eilitta, the Deputy Director.

Drs. De Vries and Kaylegian appreciate the hospitality and friendliness of the stakeholders they met in Nepal during the assessment visit in February 2017. These stakeholders were very willing so show their farms and seemed frank when discussing their accomplishments, problems, and opportunities. We were offered tea or coffee everywhere. Thank you.

Recommended Citation
De Vries, A. and Kaylegian, K. 2018. Rapid assessment of the gaps in dairy cattle feeding, management and milk processing that constrain milk quality and quantity in Nepal. Gainesville, FL, USA: Feed the Future Innovation Lab for Livestock Systems.

Essential Bibliographic Information
Leader with Associates Cooperative Agreement Award No. AID-OAA-L-15-00003

Sponsored by the USAID Bureau for Food Security

Sustainably intensifying smallholder livestock systems to improve human nutrition, health, and incomes

Acronyms

ADS	Agriculture Development Strategy
AFU	Agriculture and Forestry University
ASF	Animal-Source Food
CDCAN	Central Dairy Cooperative Association, Nepal
CFU	Colony Forming Units
DDP	Dairy Development Policy
DIA	Dairy Industries Association, Nepal
DFTQC	Department of Food Technology and Quality Control
DLS	Department of Livestock Services
GDP	Gross Domestic Product
GHP	Good Hygiene Practices
GMP	Good Manufacturing Practices
GoN	Government of Nepal
HICAST	Himalayan College of Agricultural Sciences and Technology
IFAS	Institute of Food and Agricultural Sciences
ILRI	International Livestock Research Institute
MoAD	Ministry of Agriculture Development
MoLD	Ministry of Livestock Development
MT	Metric Tons
NARC	Nepal Agricultural Research Council
NASRI	National Animal Science Research Institute
NCRP	National Cattle Research Program
NDA	Nepal Dairy Association
NDDB	National Dairy Development Board
NGO	Non-government Organization
SNF	Solids-not-fat
TDN	Total Digestible Nutrients
UF	University of Florida
US	United States
USAID	United States Agency for International Development
WTO	World Trade Organization

Contents

1. Introduction

The US Agency for International Development (USAID) awarded the University of Florida's (UF) Institute of Food and Agricultural Sciences (IFAS) funds to establish the Feed the Future Innovation Lab for Livestock Systems. This five-year initiative (October 2015 to September 2020) supports USAID's agricultural research and capacity building work under Feed the Future, the US Government's global hunger and food security initiative. The International Livestock Research Institute (ILRI) is the UF/IFAS partner in implementation of the Livestock Systems Innovation Lab. The six target countries for this project are: Burkina Faso and Niger in West Africa; Ethiopia and Rwanda in East Africa, and Nepal and Cambodia in Asia.

The Livestock Systems Innovation Lab aims to improve the nutrition, health and incomes of the poor by sustainably increasing livestock productivity and marketing, and consumption of animal-source foods (ASF). This aim will be achieved by introducing new location-appropriate technologies, by improving management practices, skills, knowledge, capacity and access to and quality of inputs across livestock value chains, and by supporting the development of a policy environment that fosters sustainable intensification and increased profitability of smallholder livestock systems.

2. Background on the dairy sector in Nepal

Agriculture is the mainstay of Nepal's economy. In the agricultural sector, the livestock subsector contributes about 14% of national gross domestic product (GDP) and 32% of the agricultural GDP (MoAD, 2012). The dairy sector (cattle and buffalo) accounts for about 60% of the livestock subsector's contribution to Nepal's GDP. Despite the relatively small contribution of the dairy sector to Nepal's GDP, dairy farming affects the livelihood of many rural people. Nepal's dairy cattle number are estimated to be 7.27 million cows and 5.24 million buffaloes (MoLD, 2016). Only 13% of the cattle and 26% of the buffaloes are improved breeds (NARC, 2016).

The average farm size is small (0.7 ha; CBS, 2013). Over the past decade there has been an increasing feminization of agriculture, largely a result of outmigration of young men who look for better opportunities elsewhere. There are now more women than men engaged in agricultural activities (72% of women, 60% of men, in 2010), which have diverse impacts on agriculture and livestock (Tamang et al., 2014). Table 1 gives an overview of the typical farms in different regions in Nepal.

At present, the total milk production in the country is about 1,734 thousand Metric Tons (MT), of which milking buffaloes contribute about 70% and dairy cows contribute about 30% (MoAD, 2012). Dairy farming in Nepal is predominantly through smallholder production systems. At present, approximately 125,000 farm families are engaged in milk production and are organized in about 1,500 primary dairy cooperatives throughout the country (FAO, 2010). It is estimated that almost 90% of total milk received by the formal dairy processing industry in the country comes through dairy cooperatives (MoLD, 2016).

Government Institutions Involved in Promotion of Milk Production in Nepal

In Nepal, the Department of Livestock Services (DLS) under the Ministry of Livestock Development (MoLD) is an apex body involved in formulating policy and implementing programs for increasing quantity of milk, whereas the Department of Food Technology and Quality Control (DFTQC), another government body under the Ministry of Agriculture Development (MoAD), is responsible for regulating dairy products in the market. Because Nepal is a member of the World Trade Organization (WTO), dairy product safety related issues have become one of the priority areas of the government of Nepal (GoN). Regulation of the raw milk standards and safety is enforced through the Nepal Food Act of 1966. However, this Act does not cover the

quality of raw milk from the farm to the chilling centers' level. This Act only includes rules and regulations for inspecting and analyzing end dairy products.

Table 1. Characteristics of the main dairy production systems prevailing in the three main milk production areas in Nepal. (Source: Sharma and Banskota, 2002).

	Eastern Hills	Central Hills	Western Hills
Important species	Cows	Buffalo, cows (ratio 3:1)	Buffalo, cows (ratio 4:1)
Important breeds	Jersey/Holstein crosses	Murrah cross buffalo, Jersey cross cows	Murrah cross buffalo (50% of buffalo)
Average herd size	3.4 (<2 dairy cows)	3	4-5 (2.5 dairy animals)
Normal feed (daily, per head of dairy animal)	25 kg green grass (rainy season), 5 kg crop residues, 2.24 kg concentrate	30 kg grass in the rainy season; 12-15 kg of fodder leaves in winter; total 15-30% nutrients from concentrates	Green grass in rainy season, rice straw/ maize stovers, tree fodder leaves, 1.5 kg home-made concentrate during lactation; 200-700 kg commercial feed purchased per year
Feeding system	Stall feeding	Stall feeding	Stall feeding
Animal performance			
Age at first calving	28 months	3-4 years for improved buffalo, 5 years for native buffalo	4 years for local buffalo, 2.5 years for cross-bred cows, 4 years for local cows
Milk productivity	8.37 L/day (2660 L/lactation)	5.2 L/day for Murrah buffalo, 3.5 L/day for native buffalo (1590-1920 L/lactation)	3.5 L/day for local buffalo, 4.7 L/day for Murrah buffalo, 6.3 L/day for crossbred cattle
Calving interval	13 months	14-15 months	NA
Lactation period	315 days	305 days	NA

Policy Environment

The Dairy Development Policy (DDP) 2008 approved by GoN is a main document guiding the dairy industry in the country and covers diverse aspects such as dairy imports and exports, transportation, key elements of good manufacturing practices (GMP), and milk collection, processing and packaging, among others (FAO, 2010). The Agriculture Development Strategy (ADS 2015-2035; ADS, 2014) is a comprehensive long-term strategy implemented from fiscal year 2015/2016 and will guide the transformation of agriculture, including the dairy industry, over the next 20 years. Other relevant policies are the Agriculture Business Promotion Policy and the Industrial Policy. In addition, the recently formed MoLD is tasked to prioritize the activities of the livestock subsector.

Dairy Management

Nepal produces about a third less feed than it needs for its livestock, on a dry matter basis. Production of crop residue meets demand, but the more nutritious green fodder and concentrates are greatly lacking (only

54% and 67%, respectively, of the demand) (Pande, 1997). Crop byproducts and residues contribute about 47% of the total digestible nutrients (TDN) (Upreti and Shrestha, 2006). While limited supplies of feed are apparent, there are also limitations to the efficient utilization of byproducts and fodder resources.

Cows are typically housed in sheds. Milking is mostly done by hand in a bucket. Floors are wet and dungs are not removed from floors periodically, thereby increasing the source of infection for contagious diseases like mastitis and also for contaminating milk. Poor farm sanitation and unhygienic milking practices are primary risk factors for high prevalence of mastitis in Nepal (Dhakal et al., 2007). Coliform mastitis was the most frequent mastitis found in the university buffalo farm of the Agriculture and Forestry University (Subedi and Dhakal, 2002). The economic impact of clinical mastitis in dairy cattle is US$63 per buffalo per lactation, due to reduced milk yield, quality, shelf life, and lower fat content. The economic impact includes US$30 for treatments, veterinary services, and extra labor to care for sick livestock (Dhakal and Thapa, 2002).

Milking Collection and Processing

The problem of milk quality is mainly due to milk being contaminated at the farm level due to manure and lack of personal hygiene (Sharma and Banskota, 2002; FAO, 2010). Cleanliness of the milking vessels, storage vessels and transport cans are often not satisfactory (FAO, 2010). Farmers may only use plain water, and in a few cases use detergents/ash to clean the utensils. In several cases, the water itself has been found to be the potential source of bacterial contamination of milk. There is no consistency in the use of chemicals. Most of the storage and transport utensils are jerry cans and buckets made of non-food grade plastics, which cannot be easily cleaned or sanitized. Many of these problems exist because of lack of training. In some cases, to prevent the spoilage and extend the shelf life of milk, adulteration of milk is done with some extraneous substances such as sodium bicarbonate, sugar and urea which are added to the milk (Samarth-Nepal, 2016).

In Nepal, ASF, including milk, commonly have poor food safety standards (Upadhaya et al., 2012; Maharjan et al., 2006; Shrestha and Bindari, 2012; Adhikari et al., 2012; Arjyal et al., 2004). Arjyal et al. (2004) reported that bacterial growth (including coliforms, which are environmental pathogens) was evident in almost all the 140 milk samples tested from the Kathmandu valley. A recent milk market investigation conducted by the government's DFTQC found coliforms present in raw milk marketed in the Kathmandu valley with up to 2400 colony forming units (CFU)/100 ml, which is much higher than an acceptable level of 1000 CFU/100 ml (DFTQC, 2013).

3. Purpose of the assessment

The first purpose of the assessment visit was to obtain a clearer understanding for the Livestock Systems Innovation Lab of the gaps in feeding and management of cows, as well as milk processing, that constrain milk quality and quantity in Nepal. This was done by assessing current practices on smallholder dairy farms, at milk collection centers and milk cooling (chilling) centers, and in processing plants to verify the findings of the background information collected prior to the assessment.

The second purpose was identifying potential points of intervention for inclusion in new training materials for stakeholders and training of trainers. These training materials complement and augment existing training materials, as well as a proposed training program, and will be designed for local trainers such as dairy cooperative personnel, extension agents, and community animal health workers.

The assessment team will assemble the training materials and plans to return to Nepal to perform the training of the trainers at a later stage with yet to be identified local institutions that will take the lead in the longer term training activities. These training materials and the training program will lead to improved milk production, quality and safety.

4. Methodology

A comprehensive review of the literature, activities, training curricula, and findings on the dairy value chain in Nepal was completed in 2016 and formed the background information of the assessment team prior to the assessment visits. This review is briefly summarized above.

A rapid assessment was conducted in Nepal in February 2017. The rapid assessment consisted of various visits to farms, milk collection centers, milk chilling centers, processing centers, and discussions with various dairy sector stakeholders, to get a holistic view of the challenges and opportunities for training in the Nepal dairy sector. The team was composed of Dr. Albert De Vries, Professor, Department of Animal Sciences at the University of Florida and Dr. Kerry Kaylegian, Research and Extension Associate (currently Assistant Research Professor), Department of Food Science at The Pennsylvania State University. They worked together with a local dairy expert (Mr. Bhola Shankar Shrestha from Heifer International Nepal) who arranged all visits and accompanied the team throughout the entire period (February 6-10, 2017). The agenda of the assessment visits are listed in Annex 1. A list of key stakeholders that were met is given in Annex 2.

5. Findings

General

- Most of the stakeholders in Nepal were keenly **aware** of the major problems and opportunities facing the dairy industry in Nepal. However, they were likely not aware about the detailed techniques and methods to solve some of these problems, such as practicing good hygiene. We were often told that "farmers simply don't know." Lack of training and lack of access to training materials contribute to the problem. Further, few (financial or cultural) incentives exist to change practices. Or the incentives are not clear. It is not clear how knowledge transfer is sustainable without incentives to change practices.
- Our observations in Nepal were generally in agreement with the **background information** provided to us before the visits.
- **Milk quality** means fat and Solids-non-fat (SNF) to the many stakeholders we talked with. It does not mean measures such as aroma, somatic cell count, bacterial count, or shelf life, which are commonly associated with milk quality in the US Milk quality in terms of somatic cell counts or bacterial level is generally not measured and not known in Nepal. Short shelf life of pasteurized milk is considered a major problem, however. In this report, we will use the definition of milk quality common in the US. These different definitions hinder communication about milk "quality" with stakeholders in Nepal.
- **Sanitation** was an issue throughout the production and processing continuum. We saw water and soap at some farms but also a milker moving manure out of the way with his hand. There seemed to be little awareness regarding personal hygiene around milking. We were told that knowledge regarding sanitation of milk equipment was lacking. We were unable to observe the milking procedures being followed during milk harvesting. The milk collection centers we visited collected milk twice per day (morning and evening), but we do not know if milk was chilled on the farm before being collected, or the time taken from harvesting of milk in the farm to milk collection and chilling. It is critical (albeit challenging) to communicate the importance for proper sanitation of cows, milking equipment, milk cans for transportation, processing equipment and post-processing handling of milk in all capacity development activities. Demonstrations on proper ways to clean hands, cows, and equipment for milking and processing would be useful, but they need to include good information on why cleaning is important and should be done consistently. The use of regular cleaning with detergents (caustic) and daily sanitizing in processing plants will improve the quality and shelf life of dairy products.
- Many young Nepali do not want to work on and with dairy farms. It is difficult to keep skilled and **trained young people** interested in the sector. If the sector used more technology, they might be more interested in dairy farming.

- We heard from many stakeholders that **seeing** something in person is the preferred method of learning. Classroom lectures do not work well. Farmers and their trainers need access to improved farms (model farms) that practice production practices that are within reach of the common dairy farmer. Such farms should be the same size (small), use the same resources, etc.
- We often heard that there is a need for **practical hands-on training** in dairy management and processing. This includes seeing and working with good practices. It was often suggested to us that an internship program in the US for several weeks or months would be ideal to train trainers. These trained Nepalis would go back to Nepal and have a commitment to work in the dairy sector in Nepal. However, such a program would need to be tailored to what are feasible production practices in Nepal.
- Everybody had a **cell phone**. Solar panels were used to provide electricity if electricity was not available otherwise. Distance education through cell phones is a possibility.

Dairy Farm Management

- Dairy cattle that are **no longer productive** are a burden on the farm because they legally cannot be slaughtered. This includes young male calves. These cattle are often poorly cared for (to reduce costs) or let go. It was not made clear to us what happens with such cattle. Buffalo can be slaughtered. Use of sexed semen would diminish the problem of male calves but could create a surplus of dairy heifers.
- We received mixed messages about the need for **more heifers**. On the one hand, a heifer resource center was built to supply pregnant heifers to farmers. On the other hand, feed availability limits the number of cows farmers will have. There did not seem to be a shortage of heifers when we visited.
- The **genetic merit** of the dairy cattle was low compared to what is available in the US. Most dairy cattle were of Holstein Friesian or Jersey origin. Often all farms associated with a veterinary technician, who also does the artificial breeding, use the same one bull on all their heifers and cows for 1.5 years. Then the bull gets replaced. This practice leads to a high risk of low genetic progress if the bull is of low genetic merit.
- **Cow comfort** was often lacking. There was a general lack of good quality forages, water, heat stress abatement, and comfortable laying places on the farms visited.
- **Mastitis** (udder infection) was considered a real problem by dairy farmers. The fact that **mastitis** reduces milk production and fertility was often not well understood. We heard of poor understanding about the need to maintain a withdrawal period (milk not to be sold) for drug residues. We saw suckling dairy calves at several farms that might harm the teats and increase the risk for infection.
- **Infertility** was also said to be a major problem, but number of breedings per conception was not low based on the information we received. It was not clear what fraction of the cattle was not pregnant. No farmers showed records to support their claims.
- **Water** availability to cattle was an issue we observed on several farms. There was no limit to access to water by the farmers, but knowledge about the quantity that cattle need was lacking.
- **Forage quality** and availability was a problem we heard about from many stakeholders. Forage growth is seasonal, so during the dry (winter) season no fresh forage and only hay is available. Silage is not made but many stakeholders mentioned silage as an option to invest in. Others, however, said that silage making had been investigated quite a bit but was not adopted by farmers. An inexpensive working silage making method or program could have a big impact on dairy production in Nepal.
- **Price of concentrate** (wheat bran based) was said to be very high compared to the price of wheat and the price of milk. Farmers did not understand why the cost of wheat bran was higher than the cost of wheat. The farmers told us that the high concentrate price was a political decision they could not affect.
- Often one feed concentrate kind was available from the cooperative. It appears that the formulation of the concentrate did not to change during the year, although the availability and quality of forages was seasonal and therefore different feed concentrates are needed for a balanced ration. **Ration formulation** to make improved balanced feed rations would be helpful. Feed stuffs also need to be analyzed for nutritional composition so shortages in the composition may be addressed.

Milk Collection and Processing

- Milk appears to be never or **seldom rejected** at the milk collection centers. There is therefore no incentive for farmers to improve milk quality once it reaches the milk collection center. We heard that milk is adulterated sometimes to increase the price per kg of milk or to increase the volume of milk sold.
- We saw many opportunities for **improving milk quality.** The most important were improvement in sanitation practices, starting with hygienic milking practices, and proper cleaning of production and processing equipment. Demonstrations of proper cleaning, along with access to detergents, sanitizers, and brushes would make the most impact in a short timeframe. Training in GMPs, laboratory and operations skills is an important target for the larger processors. Another target educational area is to broaden the definition of "milk quality" beyond the fat and SNF targets and to focus on microbial quality indicators to help with product shelf life and diversification. A list of quick, practical milk quality tests that milk collection centers might be able to use includes (a) organoleptic evaluation, (b) Clot on boiling test, (c) Alcohol test, (d) Sediment test, and (e) Resazurin test. Another test is the California Mastitis Test. A problem for the adoption of improved practices is that farmers are not paid for better milk quality.
- Several of the processors expressed a need for **training of processing plant personnel** in basic concepts in GMPs such as personal hygiene and sanitary operations and equipment. There is also an interest in more training of laboratory personnel and plant personnel. The processers explained that schooling and training in Nepal is primarily theoretical, but there is a great need for hands-on practical training.
- There is an interest in **expanding the product line** to include more cheeses and other specialized products that can help processors find their own niche in the market place, instead of everyone producing fluid milk and curd and competing for their own customers. The manufacture of cheese and other products will be greatly affected by the microbial quality of the raw milk. The quality of products will depend on improvement in sanitation at milking to reduce microbial contamination and getting milk cold as soon as possible after milking and keeping it cold until it reaches the processing plant.

6. Recommendations

From the various visits and stakeholders interviewed, as well as the background information, the following recommendations for further steps are made.

National/Macro level

- Engage with stakeholders in Nepal to develop projects that are specific, measurable, attainable, relevant and timely.
- Address the high price of feeding ingredients to improve dairy cattle rations.
- Provide incentives for dairy farmers, milk collection centers and milk chilling centers to provide milk with higher milk quality. Such incentives can be monetary or cultural such as awards, prestige, rankings, etc. Apply concepts from behavioral economics to formulate such incentives (https://en.wikipedia.org/wiki/Behavioral_economics).

Potential projects

- Establish rapid nutrient analysis equipment (Near Infra-Red) at Nepal Agricultural Research Council (NARC) or DLS lab so that the major concerns on the quality of feeding resources can be addressed in a reasonably small time with appropriate and affordable supplements. This project would complement and enhance the Livestock Systems Innovation Lab funded project "Feeding Support Tool Development for Enhancing Dairy Animal Productivity for Improved Livelihood of

Smallholder Dairy Farmers in Nepal" (http://livestocklab.ifas.ufl.edu/projects/mr-bhola-shankar-shrestha/).

- Develop a training program for train the trainers on practical dairy management such as availability of water, cow comfort and personal and cattle hygiene. This project would complement and enhance the Livestock Systems Innovation Lab funded project "Improving Dairy Animal Productivity and Income of Dairy Farmers through Effective Control of Mastitis Disease" (http://livestocklab.ifas.ufl.edu/projects/dr-keshav-prasad-sah/).
- Support to establish model dairy animal farms at three locations in dairy pockets of the country. These may be modifications of existing farms where adoptable and simple technologies can be demonstrated, such as availing water 24 hours, plastic bag silage technique, adoption of good hygiene practices and others.
- Pilot Good Hygiene Practice (GHP)/GMP implementations at milk collection and chilling centers (three strategic locations) and training of trainers, milk handlers and farmers on GHP/GMP. Activities could build on learnings from the Livestock Systems Innovation Lab funded project "Improving Dairy Animal Productivity and Income of Dairy Farmers through Effective Control of Mastitis Disease."
- Conduct economic analyses of dairy farming, including identifying areas to reduce the cost of milk production and recommend appropriate farm sizes for different settings (availability of resources, markets, etc.). Do a cost of production survey with students and faculty from the Agriculture and Forestry University (AFU). This can be combined with AFU's quest to enhance their dairy curriculum by increasing instruction in economics and decision making of dairy farming.
- Implement simple milk quality measurement systems at various milk collection centers. Measure bacteria, somatic cell count, or other measures of quality that affect shelf life (example: technology used in Rwanda projects by Livestock Systems Innovation Lab). Implement competitions within milk collection centers for milk quality, with rewards that are non-financial (blue ribbons, awards, rankings, photos in newspaper [behavioral economics]) and eventually financial (zero-sum penalty/price structure within the milk collection center). Have AFU or Himalayan College of Agricultural Sciences and Technology (HICAST) students and faculty monitor the implementation. Document the level of milk quality over time and the impact of training or a bonus system. Survey winning farms to learn about their management practices.
- Organize internships in the US for local trainers and assist with curriculum development for dairy science students in Nepal.

7. Next steps

- Reach out to stakeholders in Nepal to make concrete project proposals.
- Develop training materials and training curriculum for training of trainers workshops.
- Consult with potential training institutes to take on training courses.
- Explore funding possibilities for the potential projects identified and outlined in section 6.

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9. Appendices

Annex 1 – Agenda of the rapid assessment visit

Date	Time	Activities
2017/02/06 Monday	11:00-13:00	Travel to Chitwan from Kathmandu by air, lunch in Bharatpur
	13:00-13:30	Travel to Geetanagar
	13:30-15:30	Discussion at Annapurna Milk Producers Cooperative, observation of collection and the chilling/ processing plant operated by the Cooperative
	15:30-17:00	Farms visits (small, medium and large) near Cooperative
	17:00-17:30	Travel to Bharatpur and night stay
2017/02/07 Tuesday	07:30-08:00	Travel to Mukundapur
	08:00-09:30	Discussion at Mukundasen Milk Producers Cooperative
	09:30-11:30	Farms visits (small, medium and large) near Cooperative
	11:30-13:00	Travel to Bharatpur, lunch
	13:00-13:30	Travel to Agriculture and Forestry University (AFU), Rampur
	13:30-15:30	Interaction with Professors from livestock sector at AFU, and Scientists from the National Cattle Research Program (NRCP) at Rampur, observation of cattle farm of NCRP at Rampur
	15:30-17:00	Visit Bijaya Dairy at Bijayanagar, Mangalpur
	17:00-17:30	Travel to Bharatpur and night stay
2017/02/08 Wednesday	07:30-08:00	Travel to Devghat
	08:00-10:00	Visit Heifer Nepal's promoted Women's Milk Cooperative, visit farms
	10:00-10:30	Travel to Kumroj, Ratnanagar
	10:30-11:30	Visit Laligurans Cattle Research Centre (Private)
	11:30-12:00	Travel back Bharatpur
	12:00-13:00	Lunch
	13:00-15:30	Move to airport and travel to Kathmandu
	15:30-16:00	Travel to hotel
2017/02/09 Thursday	08:15-09:30	Travel to Nepal Dairy Hattiban. Meeting with Chairperson A. Rajbandary and observation of plant
	09:30-10:15	Travel to Heifer International Nepal. Meeting with Country Director
	10:15-11:30	Travel to MoLD Singhdarbar. Meeting with Secretary MoLD and team
	11:30-12:30	Travel to DLS Hariharbhawan. Meeting with Dr. Nirmal (DG) and team
	12:30-13:00	Lunch
	13:00-16:30	Travel to HICAST Kalanki. Meet Dr. Shrestha, faculty and students, give seminar
	16:30-17:30	Travel to hotel
2017/02/10 Friday	09:00-10:30	Interaction at NDDB Hariharbhawan with NDDB team and representatives from NDA, DIA and CDCAN
	10:30-11:30	Travel to NASRI Khumaltar. Meeting with Dr. TB Gurrung (NASRI director) and his team
	11:30-12:30	Lunch and leave for airport to fly back to US

Annex 2 – Partial list of persons met during the rapid assessment

- Dairy farmers (30 approximately)
- Milk collection center and chilling center directors and employees
- Dairy industry leaders from various organizations
- Dr. Kehav Sah, Senior Program Manager, Heifer International Nepal
- Dr. Suyog Subebi, Program Officer, Heifer International Nepal
- Dr. Shubh Narayan Mahato, Country Director, Heifer International Nepal
- Mr. Sumit Kedia, Director, Sitaram Gokul Milks Ktm. Pvt. Ltd.
- Dr. Rima Devi Shrestha, Associate Professor, HICAST
- Dr. Bidur P. Chaulagain, Professor, HICAST
- Dr. Nirajan Bhattarai, Assistant Professor, Agricultural and Forestry University
- Dr. Dawa Tshiring Tamang, Assistant Professor, Agricultural and Forestry University
- Mr. Arniko Rajbhandari, Director, Nepal Dairy Pvt. Ltd.
- Dr. H. B. Rajbhandari, Executive Chairman, Nepal Dairy Pvt. Ltd.
- Dr. Madhav P. Acharya, Coordinator, National Cattle Research Program
- Dr. Banshi Sharma, Project Director, Nepal Livestock Sector Innovation Project
- Dr. Yubak Dhoi, Secretary, Ministry of Livestock Development
- Dr. T.B. Gurrung, Director, National Animal Science Research Institute
- Dr. Nirmal, Director General, DLS Hariharbhawan

Annex 3 – Pictures taken during the rapid assessment

Above: Milk collection centers in the Terai

Above: Cattle and buffalo housing in the Terai

Above: Housing conditions in the Terai

Above: Processing facilities and packaging in South Nepal

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