



FEED THE FUTURE

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

FEED THE FUTURE INNOVATION LAB FOR LIVESTOCK SYSTEMS

Report on the Assessment of Forage and Non-Forage Laboratories in Burkina Faso

December 2019

by the Human and Institutional Capacity Development team
of the Management Entity at the University of Florida



USAID
FROM THE AMERICAN PEOPLE

BILL & MELINDA
GATES *foundation*

ILRI
INTERNATIONAL
LIVESTOCK RESEARCH
INSTITUTE



UF | **IFAS**
UNIVERSITY of FLORIDA

Acknowledgement

This country-specific report was prepared by Mr. Richard Fethiere, Coordinator of Research Programs, Agronomy Department, IFAS, and Dr. Nargiza Ludgate, Assistant Scholar, International Center, University of Florida.

Recommended Citation

Fethiere, R. and Ludgate, N. 2019. Report on the Assessment of Forage and Non-Forage Laboratories in Burkina Faso. Gainesville, FL, USA: Feed the Future Innovation Lab for Livestock Systems.

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

Disclaimer

This work was funded in whole or part by the United States Agency for International Development (USAID) Bureau for Food Security under Agreement # AID-OAA-L-15-00003 as part of Feed the Future Innovation Lab for Livestock Systems. Any opinions, findings, conclusions, or recommendations expressed here are those of the authors alone.

Table of Contents

Abbreviations.....	ii
Executive summary:	1
Introduction.....	1
Assessment objectives	2
Methodology.....	2
Limitations of the assessment.....	3
Types of laboratories visited	4
Research laboratories	4
University laboratory.....	4
General findings	4
Facilities	13
Other training needs	14
Lab-related courses in Academia: Existing courses and potential to develop new courses.....	14
Recommendations	14
Conclusions.....	15

Abbreviations

ADF	Acid detergent fiber
ADL	Acid detergent lignin
ASF	Animal-source foods
DM	Dry matter
HICD	Human and institutional capacity development
IFAS	Institute of Food and Agricultural Sciences
ILRI	International Livestock Research Institute
IVOMD	In vitro organic matter digestibility
N	Nitrogen
NDF	Neutral detergent fiber
NIRS	Near infrared spectrophotometry
OM	Organic matter
PPE	Personal protective equipment
SOPs	Standard operating procedures
UF	University of Florida
USAID	United States Agency for International Development

Executive summary:

This report summarizes the findings from the rapid assessment of forage and non-forage laboratories in Burkina Faso to determine their strengths and weaknesses in relation to how they can support research, extension, and education activities of the livestock sector. The assessment targeted laboratories that are operated by public universities, and international or government research entities in Burkina Faso that partner with the Feed the Future Innovation Lab for Livestock Systems. The assessment included meetings with forage and non-forage lab personnel and users of lab facilities, such as researchers, academics, and students. During this assessment the forage research sites near Ouagadougou and Bobo-Dioulasso were also visited. The research at these sites is being conducted through field experiments and feeding trials by research organizations and universities that are partners of the Livestock Systems Innovation Lab in Burkina Faso.

The primary objective for this assessment was to determine the professional development training needs of the laboratory personnel and users in Burkina Faso. The assessment team was comprised of the University of Florida laboratory specialist from the Department of Agronomy, Mr. Richard Fethiere, who manages the forage lab and forage research activities, and the Livestock Systems Innovation Lab's country coordinator, Dr. Isidore Gnanda, and EQUIP project coordinator, Dr. Nouhoun Zampaligre, who developed the assessment itinerary as well as provided context to visiting labs and institutions.

The labs face challenges (e.g., broken/malfunctioning equipment and instruments, etc.), there is also considerable need for training in lab management, lab operations and lab safety. Such training should be offered at each lab for any new users as well as the refresher training for lab personnel. At all labs visited, the users and managers expressed that training in lab management is crucial to the operation of the labs.

Introduction

The U.S. Agency for International Development (USAID) awarded the University of Florida (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 U.S. 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 Lab 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.

One of the crosscutting themes of the Livestock Systems Innovation Lab is the Human and Institutional Capacity Development (HICD) component, which emphasizes the connection between strengthening the capacity of an individual and organizations, and systematic change at the institutional and enabling environment levels in target countries. HICD works with partner organizations of the Livestock Systems Innovation Lab to build their technical and scientific capacities through various direct and indirect activities

of the Innovation Lab. This assessment to evaluate the current status of research laboratories was requested by HICD team and is an integral part/component of the HICD activities in Burkina Faso.

This report summarizes the findings from the rapid assessment of forage and non-forage laboratories in Burkina Faso to determine their strengths and weaknesses in relation to how they can support research, extension, and education activities of the livestock sector. The assessment included meetings with forage and non-forage lab personnel and users of lab facilities, such as researchers, academics, and students. During this assessment the forage research sites near Ouagadougou and Bobo-Dioulasso were also visited. The research at these sites is being conducted through field experiments and feeding trials by research organizations and universities that are partners of the Livestock Systems Innovation Lab.

The interviews and visits to labs helped assess the operational strengths and weaknesses of the forage and non-forage labs at the individual (lab personnel), organizational (lab management, infrastructure, and equipment), and enabling environment (lab policies and regulations that guide lab services) level. The interviews were intended to determine how labs function and operate as well as the training needs of lab personnel and users, and other collaborative arrangements for strengthening the livestock research, extension, and teaching capacities through the use of improved laboratory services. The Livestock Systems Innovation Lab's country coordinator, Dr. Isidore Gnanda, and EQUIP project coordinator¹, Dr. Nouhoun Zampaligre, were instrumental in developing the assessment itinerary and organizing various meetings and visits to the labs and forage research sites, clarifying the context of laboratory activities in the country and accompanying Mr. Richard Fethiere from the University of Florida during the assessment visits.

This report provides the findings of the rapid assessment, the needs identified during the assessment, and the recommendations made to address the needs.

Assessment objectives

The primary objective for this assessment was to determine the professional development training needs of the laboratory personnel and the lab users in Burkina Faso. Additional objectives included an assessment of current challenges and needs in the existing labs to conduct lab experiments and research aimed at improving ASF production in Burkina Faso. Specifically, this entailed an assessment of laboratory management's technical proficiency, capacity-related deficiencies among lab technicians, scientists, academics and students, and operational policies guiding lab work (i.e., manuals or Standard Operating Procedures (SOPs)).

Methodology

The assessment methodology involved visiting actual labs for forage and non-forage work and meeting with lab administrators and technicians, as well as with users (academics, researchers, and students) to inquire about their lab experiences and their views on how labs could be improved. The interviews were conducted using a semi-structured format supported by visual observations of lab facilities and equipment.

¹ EQUIP is a project funded by the Bill & Melinda Gates Foundation. EQUIP- Strengthening smallholder livestock systems for the future project strives to improve the incomes, livelihoods and nutrition of smallholder farmers. In Burkina Faso, the project conducts research activities in feeds for the livestock sector. The EQUIP Project Coordinator oversees feed activities in Burkina Faso.

The assessment was conducted by the University of Florida laboratory specialist from the Department of Agronomy, IFAS, who manages the forage lab and forage research activities – Mr. Richard P. Fethiere. Mr. Fethiere worked with the HICD team member who oversaw the assessment and the Livestock Systems Innovation Lab country coordinators who developed the assessment itinerary as well as provided context to visiting labs and institutions.

The methodology was designed in a way that it would help identify gaps in professional development that can be addressed through short-term trainings. The assessment plan involved visiting forage sites from where forage samples are produced in the fields and following their path to the laboratory, where they are analyzed and shared with researchers or clients in the form of results reports. Due to Mr. Fethiere's technical expertise in forage lab operation and forage trials in the field, only forage sites were visited to map the path of forage samples to the lab. Where available, the lab protocols, including SOPs, were reviewed during lab visits to determine the scope and extent of various procedures and how they are followed by lab personnel and users during their lab work.

The work was guided by the identification of certain component factors that contribute to the effective lab service delivery. These were systematically assessed in each of the facilities visited. These included:

- Policies regulating laboratory operations
- Human resource capacity (total number and qualifications of personnel)
- Availability of continued professional education, operational research and training
- Structure, operations and management of laboratories
- Health and safety procedures in place
- State of the physical infrastructure
- State/availability of equipment, reagents and lab consumables
- Lab procurement procedures
- Quality assurance
- Laboratory information management
- Financing status of the laboratories

Where available, the background information on the laboratories was obtained through a desk review of relevant literature (e.g., reports) and in consultation with the country coordinators.

Limitations of the assessment

The assessment encountered some limitations. First, due to the lab specialist's expertise, the primary focus of the assessment was on forage labs. Non-forage labs were also visited and assessed but mostly from the perspective of the state of physical infrastructure, equipment and general lab management aspects. Second, hardly any background literature on laboratory facilities in Burkina Faso was available. Finally, policy or regulatory documents were not readily available and the familiarity of some interviewees with the content of such documents was limited. No laboratories outside of Ouagadougou and Bobo-Dioulasso areas were not visited due to security situation in Burkina Faso. Gaps resulting from these limitations were filled based on the information provided by the country coordinators.

Types of laboratories visited

The assessment targeted labs that belonged by public universities and international or government research entities in Burkina Faso that partner with the Feed the Future Innovation Lab for Livestock Systems.

Research laboratories

- Laboratory of Plant Genetics and Biotechnology, located in Ouagadougou.
- INERA CREAM (Centre de Recherches Environnementales Agricoles et de Formation), Laboratory of Animal Biology and Health, Ouagadougou.
- INERA CREAM, Laboratory of Animal Nutrition and Biology, Ouagadougou.
- Laboratoire National D'Elevage (part of the Direction Generale des Services Veterinaires), Ouagadougou.
- INERA CREAM CNRST Laboratory Soil-Water-Plant, located in Bobo-Dioulasso
- INERA Laboratoire Mixte International Patho-Bios, Bobo-Dioulasso.

University laboratory

- University of Ouagadougou laboratory.
- Laboratoire des Systemes Naturels, Agrosystemes et de 'Ingenierie de l'Environnement (Laboratory of Natural Systems, Agrosystems and Environmental Engineering) at the University of Bobo-Dioulasso.

General findings

Many HICD-related needs and gaps became obvious during the assessment. It should be noted that all buildings housing lab facilities were adequate for the purposes of lab work. Most laboratories were also adequately equipped to conduct lab experiments and tests.

Professional lab training is needed for university users (faculty, students) as well as lab personnel (management and technicians). Students are usually new to the laboratories and need all the training they can get in order to complete their research and publish findings. Laboratory managers are those who are in charge of the day to day lab operation and they will benefit the most from additional training. These individuals would constitute the target audience for trainings when offered. This professional training should focus on lab administration and management aspects, including sample intake, processing, supplies purchase, storage and use, equipment maintenance, manuals and procedures, inventory management, workflow, safety, and disposal of hazardous waste.

In all labs there is a need to promote good lab practices, to improve the quality and reliability of test data, to generate final reports and to archive data and reports. There is also a need to promote conditions where analyses are well-planned, performed successfully, recorded, reported, archived and monitored. All labs also require improvements to function in a safe manner for lab personnel and in an environmentally conscious manner for both lab personnel and the environment. Therefore, training is needed in good lab practices and laboratory safety parameters.

The labs at the University of Ouagadougou were all very well equipped and ready to run forage research with few changes that can be brought about by lab management training. For instance, they are equipped with an Ankom Fiber Digester in working order for now allowing them the ability to run NDF, ADF and Crude Fiber. However, during the visit, the assessment team looked into the digester that showed that it was getting

slowly damaged by overheating caused by a no-longer functioning timer on the unit. This was a \$10,000.00 piece of equipment that was being damaged because of a dead \$5.00 battery. The laboratory had no toolbox, which should be a must in any laboratory as part of good lab management practice. The team borrowed the Philipps screwdriver to remove the timer attached to the unit. The team was able to promptly demonstrate the lab personnel where to find the battery and replace it. A good lab management training would bring all these details to light and remind all what can be accomplished with little.

Another story with the equipment at the University of Ouagadougou's lab was related to fume hood, which was laying on the ground instead of the counter. The story is that when the fume hood indicated a problem requiring to contact the manufacturer no one followed on that. In trying to fix the hood it was decided to take it off the counter and put it on the floor compounding the problem. The lab manager didn't know where the operations' manual was but one of the lab technicians volunteered that he knew where the manual was. So partly because of the communication generated by this visit others at the lab became aware of manuals and their importance. After inspection it was determined that the company needed to be contacted to better understand the malfunction code that was given by the hood.



Figure 1 (a, b, c & d)². Various lab equipment and instruments at the University of Ouagadougou's lab.

Dr. Moussa Zongo runs a well-kept lab at the University with his team of 6 students. He works with goat reproduction. Although he runs a tight ship, he has some needs that need to be addressed if possible. He has

²All images presented in this report were taken by Mr. Fethiere during September 2019 assessment trip to Burkina Faso.

some Eppendorf pipette issues and some reagent issues. He would like to be able to run a complete semen seed analysis to determine the DNA content. Currently he can only determine mobility which is not sufficient to certify viability particularly in goats. He wants to be able to analyze the membrane to determine viability of the sperm. He would need some battery packs to replace old ones for the Easi-Scan E15410019AC from BCF Technology, IMV portable Veterinary Ultrasound (800-210-9665). He and his personnel were always leaving the power packs plugged in when not in use which probably led to the deterioration of the power pack. To his credit Dr. Zongo had in his possession all his operating manuals for the lab and promised to verify that power packs are best kept unplugged after they are full until needed again. Dr. Moussa also needs a distilled water output for an ACMAS ISO 9001: 2000 company. This lab is almost well equipped to run an in vitro organic matter digestibility (IVOMD) analysis. However, the lab was missing a furnace and a fistulated cow.



Figure 2. Dr. Zongo's research team with Richard Fethiere and Dr. Isidore Gnanda.



Figure 3 (a & b). Dr. Zongo's laboratory space at the University of Ouagadougou.

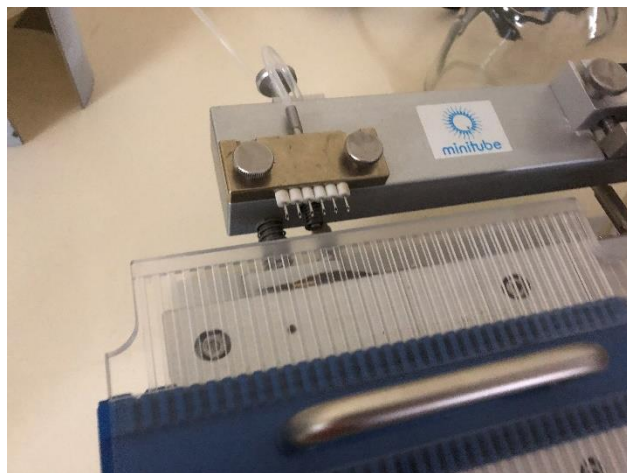


Figure 4 (a & b). Semen tubes for artificial insemination and portable ultrasound scanners.



Figure 5. Dr. Zongo and lab equipment operations' manuals.

In Bobo-Dioulasso, at the University teaching laboratory, the team met with the lab manager and technician. The lab was well equipped but it seemed that the access and use of the lab was fairly restricted. It was not possible to determine why this was the case.



Figure 6. Soil samples drying in the Laboratory of Natural Systems, Agrosystems and Environmental Engineering, University of Bobo-Dioulasso



Figure 7 (a & b). Water Incubator and oven in good working order in the Laboratory of Natural Systems, Agrosystems and Environmental Engineering, University of Bobo-Dioulasso.



Figure 8. Meeting with MS and PhD students of the University of Bobo-Dioulasso.

In Bobo-Dioulasso, the INERA/IRD/Patho-Bios laboratory is run by Dr. Issa Wonni, a researcher in Bacteriology. Dr. Wonni works in cooperation with the University of Montpellier, France. The meeting was organized at the hotel because of the security situation. By all accounts this was one of the best labs in Burkina Faso, according to those interviewed during various meetings in Farako-Ba. All their equipment was in working order and in the clean environment (without dust and dirt) as seen in Figures 9 and 10. This laboratory should serve as a resource laboratory on how a lab should be managed.



Figure 9 (a & b). Clean and well-equipped the INERA/IRD/Patho-Bios laboratory space in Farako-Ba.



Figure 10 (a & b). Mint instruments with their manuals.

In Ouagadougou, the assessment team visited the Laboratoire National d'Elevage which demonstrated about the acute need for preparing lab personnel how to manage and maintain a laboratory space. Like LABOCEL in Niger this laboratory is equipped with some up-to-date material however many were not in working order because of poor maintenance by lab personnel. There were several freezers that had stopped working because the air filters had not been cleaned or changed as recommended by the manufacturer. If the freezers have an automatic shut-off system then most of these freezers should start working again when the filters are cleaned and/or changed.

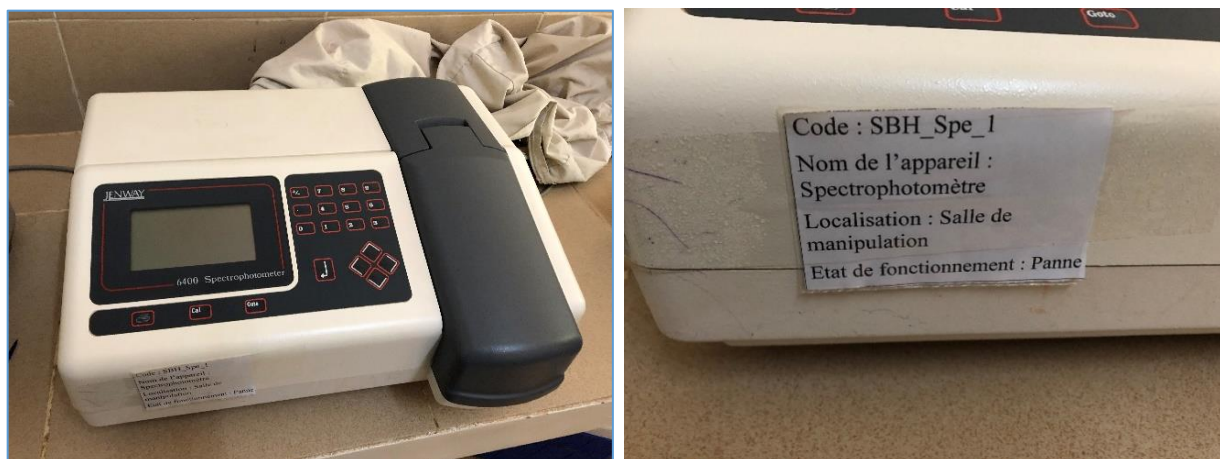


Figure 11 (a & b). Seemingly new spectrophotometer with a label indicating the current status - not in working order.



Figure 12. Non-functioning fume hood probably because of a dirty filter

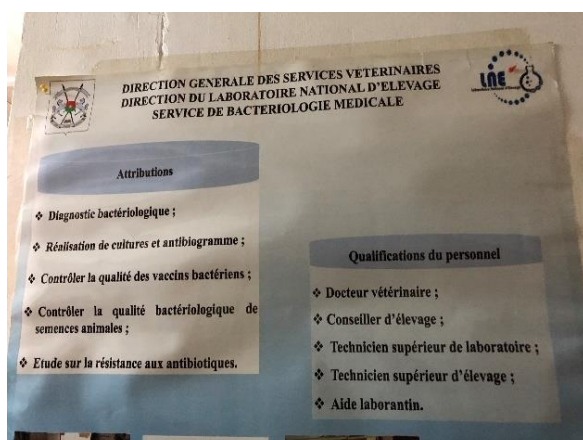


Figure 13 (a, b, c & d). Non-working freezers. (The label from 13c clearly indicates the qualification of the personnel having access to these freezers: veterinarians, livestock advisors, senior lab technicians, senior livestock technicians, and lab assistants. -70C Freezer is about to stop working as the filter had not been changed or clean in over one year. The manufacturer's recommendation is to clean or replace every 90 days and even more frequently in dusty conditions which existed in this building.)



Figure 14 (a & b). Dirty filters found in non-working freezers.

SEP Lab is currently able to run small quantities of Nitrogen, Minerals, NDF (neutral detergent fiber), ADF (acid detergent fiber), ADL (acid detergent lignin) with a DoziFiber, Dry matter (DM) and Organic Matter (OM) in small quantities at a time. This lab has a near infrared spectrophotometry (NIRS) that is yet to be installed. Mr. Ouedraogo is an outstanding lab manager and a great teacher to his technician Mr. Ouattara and will be a great resource going forward with lab analysis program in Burkina Faso.

Mr. Ouedraogo has identified the following needs for his program: 1) a calorimeter to analyze Energy; 2) IVOMD and 3) Grinders of bigger capacity to prepare forage samples for analysis.

In all labs there is a need to promote good lab practices, to improve the quality and reliability of test data, to generate final reports and to archive data and reports. There is also a need to promote conditions where analyses are well planned, performed successfully, recorded, reported, archived and monitored. All labs also require improvements to function in a safe manner for lab personnel and in an environmentally conscious manner for both lab personnel and the environment. Therefore, training is needed in good lab practices and laboratory safety parameters.

It is hard to assure quality of tests or analysis if lab instruments are not in working order. The assessment team was able to address the use of certified weights to help calibrate the balances in several labs. Some lab directors and managers did not think they had any, some knew they had such weights but would have to look for them, some had never heard of them. The team encouraged using such weights to calibrate balances in labs. Every analysis involves multiple weighing of forage samples. If the balance is not calibrated this is an obvious source for introducing errors in one's research. The subject of manuals for the balances also came up as many balances were not level. The issue of the desiccants also being in good working order came up. The desiccants observed in most labs were pink, usually a color indicating the presence of moisture inside the desiccator instead of the deep blue color indicating a dry product. Manuals for the desiccant provides the information indicating the temperature at which one can refresh the desiccant.

Facilities

The labs at the University of Ouagadougou were all very well equipped and ready to run forage research with few changes that can be brought about by lab management training. For instance, they are equipped with an Ankom Fiber Digester in working order for now allowing them the ability to run NDF, ADF and Crude Fiber. However, during the visit, the assessment team looked into the digester that showed that it was getting slowly damaged by overheating caused by a no-longer functioning timer on the unit. This was a \$10,000.00 piece of equipment that was being damaged because of a dead \$5.00 battery. The laboratory had no toolbox,

which should be a must in any laboratory as part of good lab management practice. The team borrowed the Philipps screwdriver to remove the timer attached to the unit. The team was able to promptly demonstrate the lab personnel where to find the battery and replace it. A good lab management training would bring all these details to light and remind all what can be accomplished with little.

Another story with equipment at the University of Ouagadougou's lab was related to fume hood, which was laying on the ground instead of the counter. The story is that when the fume hood indicated a problem requiring to contact the manufacturer no one followed on that. In trying to fix the hood it was decided to take it off the counter and put it on the floor compounding the problem. The lab manager didn't know where the operations' manual was but one of the lab technicians volunteered that he knew where the manual was. So partly because of the communication generated by this visit others at the lab became aware of manuals and their importance. After inspection it was determined that the company needed to be contacted to better understand the malfunction code that was given by the hood.

Other training needs

Interviews with forage lab technicians illustrated that they were involved in preparing nutritional and proximate analysis tests in the laboratory setting. In addition to good lab management training, there is a need for reviewing procedures for weighing samples in the laboratory environment. Visits to different labs showed that technicians lack this skill which could ultimately affect the results of the analysis. There is also a need for reviewing procedures for fiber analyses using the Ankom digester or using the traditional Van Soest procedure. Many Velp titration systems for Kjeldahl determination were malfunctioning. The lab technicians would need to consult the operations manuals to address the deficiencies in order to have them again in working order. Training focused on dry matter and organic matter determinations also appeared important for the proper operation of the lab from the analysis and testing aspects.

Lab-related courses in Academia: Existing courses and potential to develop new courses

In general, universities require the completion of math and science courses before enrolling in the lab courses that are included in a certificate or an undergraduate degree program. However, some concepts that are important for such courses, such as data analysis and lab techniques, sample collection, and handling and storage, are needed as pre-requisites to facilitate better learning and technical skills development. Course instructors should provide an introduction to the use and maintenance of laboratory equipment and safety procedures before users can access lab facilities to conduct any lab work. Measurement and calculation concepts should be reviewed along with scientific terminology related to laboratory procedures. Some basic concepts of chemistry should be also included with safety in mind in the course as students become familiar with toxicology and reaction hazards. To successfully conduct IVOMD analysis, basic microbiology concepts would be advisable to be incorporated in the course curricula. A new or revised lab course or a certificate program should be considered by universities guided by the main purpose of preparing the lab technicians to be comfortable in the lab environment and pass-on their knowledge and skills to users.

Recommendations

The recommendations presented below are focused on strengthening the human capacity of lab personnel and users, which is critical to re-start some labs or introduce better lab management procedures to improve the functionality of the lab environment, including the safety of lab procedures. Other issues described above

(related to the state of lab equipment) are also important but to a lesser extent until lab personnel are trained to properly maintain and care for the lab infrastructure.

- Professional lab training focused on best lab management practices is needed for all lab personnel and users, including researchers, academics, and students. This training should be offered on an annual basis by labs. It is advisable to make this training mandatory for all new users of the lab.
- Professional training is also needed to reinforce the importance of managing the lab, especially as this relate to sample intake, processing, supply purchases and storage, equipment maintenance, manuals, procedures, inventory, safety, and disposal of hazardous waste.
- A specialized protocol training is needed in the area of analyzing N, DM, OM, NDF, ADF, ADL, energy, fat, IVOMD digestibility and NIRS. These topics could be integrated into the training curricula and offered for forage lab personnel. Combining training with a hands-on practice in a local lab will help learners to master the content of the training.
- All laboratory personnel should be required to take a refresher lab training. This should include the upper management, lab directors, lab managers, and technicians. It is required for the following reason: problems can and usually start the minute some scientific equipment is purchased and an installation contract is signed with a distributor. When a distributor wins the bid, usually due to their offering the lowest price, one must ensure that training is included in the purchase contract and offered to the eventual operators and that a few first runs of the apparatus are included in that contract so the piece of equipment does not become an instant surplus. It does not reflect well on the institution receiving the equipment nor on the donor institution when valued equipment remains idle. All parties benefit from having a functional laboratory with well-trained personnel.

Conclusions

Over the course of the assessment, several forage and non-forage labs in Burkina Faso were visited. Most labs, especially the forage labs, have adequate facilities and are set up fairly well with equipment, reagents, and other lab supplies to support forage research. The researchers (from universities and research entities) along with lab technicians and students have received the necessary academic training to conduct forage essays and trials in the field and bring samples into the laboratories. However, there is a need to implement major improvements in the day-to-day laboratory management and operations. Refresher trainings should be provided on a continuous basis that over time will equip lab personnel with the necessary professional approaches to sustain functional labs and maintain lab equipment and instruments.



FEED THE FUTURE

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

Feed the Future Innovation Lab for Livestock Systems

University of Florida
Department of Animal Sciences
P.O. Box 110910
Gainesville, Florida
32611-0910

Livestock-lab@ufl.edu

<http://livestocklab.ifas.ufl.edu>