Report

Training of Trainers (ToT) on

Small Scale Feed Mechanization

Amman, Jordan 10 – 13 February, 2026

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ICARDA

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1. Introduction

Within the framework of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)-funded SURE–IMPACT project, International Center for Agricultural Research in the Dry Areas (ICARDA) successfully conducted a Training of Trainers (ToT) on Small-Scale Feed Mechanization from 10 to 13 February 2026 in Amman, Jordan.

The training aimed to strengthen the technical and organizational capacities of Yemeni lead farmers, feed machine manufacturers, and livestock researchers, equipping them with the knowledge and practical skills required to promote and implement small-scale feed mechanization solutions in Yemen. By targeting key actors along the livestock value chain, the program sought to enhance local expertise and foster sustainable feed production systems that can improve livestock productivity and farmer incomes.

The course was designed as a comprehensive and practice-oriented learning experience, combining theoretical modules, interactive discussions, hands-on technical exercises, and field exposure visits. Participants had the opportunity to visit feed machine manufacturers, steel processing companies, feed processing companies, dairy processors, and livestock farmers in Jordan. These field visits provided practical insights into machinery fabrication, feed production processes, quality control measures, business models, and operational management.

Through this integrated approach, the training facilitated the transfer of feed mechanization technologies, technical know-how, and business concepts to relevant stakeholders in Yemen. The ToT format further ensured that participants are now better positioned to disseminate the acquired knowledge within their networks, contributing to the scaling up of small-scale feed mechanization initiatives in the Yemeni livestock sector.

2. Objectives

The SURE–IMPACT project in Yemen aims to strengthen the small ruminant value chain through targeted training and capacity building of both public and private sector stakeholders. A central component of the project focuses on feed mechanization and the development of low-cost, high-quality feed resources to address prevailing nutritional constraints that limit livestock productivity.

To support this objective, the project has distributed five combined grinder–chopper units to selected farmer groups. These groups are expected to provide feed processing services to their members as well as to neighboring producers. This approach is designed not only to improve access to nutritious and affordable feed but also to establish a sustainable, income-generating service model at the community level.

Building on more than a decade of experience in developing and validating small-scale feed processing technologies, International Center for Agricultural Research in the Dry Areas (ICARDA) has organized this specialized training and exchange visit program for Yemeni participants in Jordan. These activities are intended to facilitate structured knowledge transfer, peer-to-peer learning, and direct exposure to proven feed processing and business models.

Specifically, the training aimed to:

- Enhance participants' technical understanding of small-scale feed mechanization technologies.
- Strengthen capacities in feed formulation, machine operation, maintenance, and safety.
- Improve participants' ability to assess business opportunities and develop viable service models for farmer organizations.
- Promote learning from established Jordanian enterprises and practitioners through field visits and practical demonstrations.
- Support the adaptation and scaling of feed mechanization innovations within the Yemeni context.

Through this integrated capacity-building approach, the project seeks to empower local actors to sustainably manage feed processing units and contribute to improved livestock productivity, food security, and rural livelihoods in Yemen.

3. Participants

A total of seven participants took part in the training and exchange visits. The group was carefully selected to represent key actors involved in the promotion and implementation of small-scale feed mechanization in Yemen.

The participants included:

- One feed machine (grinder/chopper) manufacturer (Mr. Labib), who plays a critical role in the fabrication, adaptation, and maintenance of feed processing equipment.
- Five representatives of farmer groups who have received combined grinder–chopper units under the SURE–IMPACT project. These participants are directly responsible for operating the machines and providing feed processing services to their members and surrounding communities.
- One representative from the Livestock Research Center (Dr. Suaad), contributing technical expertise and supporting the integration of research-based knowledge into field-level implementation.

This diverse composition ensured a balanced mix of technical, operational, and research perspectives. It also promoted peer learning and strengthened collaboration among manufacturers, farmers, and research institutions, thereby enhancing the potential for effective adoption and scaling of small-scale feed mechanization technologies in Yemen.

4. Course Content

Day 1 – Theoretical Knowledge Transfer and Interactive Discussions

The first day of the program was dedicated entirely to theoretical knowledge transfer and structured discussions with the Yemeni participants. The objective of this session was to establish a strong conceptual foundation, introduce key frameworks, and create a shared understanding of the core themes of the training.

To ensure clear and effective communication, two professional translators provided simultaneous interpretation from English (the trainer's language) into Arabic (the participants' language). This arrangement enabled smooth interaction, active participation, and immediate clarification of questions and concepts throughout the sessions.

The methodology combined formal presentations with interactive dialogue. Participants were encouraged to share their perspectives, ask questions, and relate the theoretical content to their professional experiences and the Yemeni context. This participatory approach enriched the discussions and helped contextualize the material

The day was structured around the following thematic modules:

1. Introduction

The session began with an overview of the training objectives and its relevance to the livestock sector in Yemen.

1.1 Learning Objectives

Participants were introduced to the expected outcomes of the training, including improved understanding of feed mechanization, business planning considerations, and operational requirements.

1.2 Importance of Feed in Livestock Productivity

This segment highlighted the critical role of quality feed in improving animal health, growth rates, milk and meat production, and overall farm profitability. Discussions emphasized the challenges faced by livestock producers in Yemen regarding feed availability, affordability, and quality.

2. Understanding Small-Scale Feed Mechanization

This module provided a technical overview of small-scale feed processing solutions suitable for farmer organizations.

2.1 Definition and Scope

Participants explored the concept of small-scale feed mechanization, its applications, and how it differs from industrial-scale feed production.

2.2 Types of Equipment

An overview was given of different types of small-scale feed processing equipment, including grinders, mixers, pelletizers, and related machinery. Practical considerations for selecting appropriate equipment were discussed.

2.3 Advantages for Farmer Organizations

The discussion focused on how farmer organizations can benefit from mechanized feed processing, including cost reduction, quality control, collective marketing opportunities, and enhanced income generation.

3. Business Opportunities for Farmer Organizations

This session explored the economic potential of small-scale feed mechanization as a business venture.

3.1 Income Streams

Participants examined possible revenue sources, such as feed sales to members and non-members, service provision, and value-added feed products.

3.2 Market Analysis

The trainer introduced basic tools for assessing market demand, competition, pricing strategies, and customer segmentation within local contexts.

3.3 Case Studies

Relevant case studies from Tunisia, Mali and Ethiopia were presented to demonstrate successful small-scale feed enterprises in comparable environments, highlighting key success factors and lessons learned.

4. Technical and Operational Considerations

This module addressed the practical requirements for establishing and managing feed processing units.

4.1 Raw Material Sourcing
Participants discussed strategies for identifying, sourcing, and storing raw materials to ensure quality and cost-effectiveness.

4.2 Feed Formulation Basics
An introduction was provided to basic feed formulation principles, including nutritional requirements and ingredient balancing.

4.3 Maintenance and Safety
The importance of regular equipment maintenance, workplace safety standards, and risk mitigation measures was emphasized.

5. Financial and Organizational Aspects

This session focused on financial planning and governance structures.

5.1 Investment Costs and Financing Options
Participants reviewed typical startup costs and explored possible financing mechanisms, including loans, grants, and member contributions.

5.2 Cost-Benefit Analysis
Basic financial analysis tools were introduced to assess profitability and sustainability.

5.3 Organizational Models
Different organizational structures for managing feed units were discussed, including cooperative models and private management arrangements within farmer organizations.

6. Enabling Environment

The final module examined external factors influencing the success of small-scale feed mechanization initiatives.

6.1 Policy and Institutional Support
Discussion centered on the importance of supportive policies, extension services, and institutional partnerships.

6.2 Training and Capacity Building
The need for continuous skills development and technical training was highlighted.

6.3 Sustainability and Scaling Up
Participants explored strategies to ensure long-term viability and opportunities for expansion and replication.

Overall, the first day successfully established a comprehensive theoretical foundation, stimulated active discussion, and strengthened participants' understanding of the technical, financial, and institutional dimensions of small-scale feed mechanization. This foundation prepared the participants for the more practical and application-oriented sessions planned for the subsequent days.

Day 2 – Field visit to feed processing machine manufacturer

The group of trainees from Yemen visited a feed machinery manufacturing workshop in the northern governorate of Irbid, known for its rich agricultural landscapes.

The Yemeni group, including a feed machine manufacturer, a livestock researcher, and five lead farmers met with Mr. Muyyad Al-Sadee, an owner of a feed machinery manufacturing workshop in Irbid, Jordan.

Figure 1: Trainees visiting feed machine manufacturer

For the trainees, the visit represented a unique experience to learn much more about a feed grinder-manufacturing process, in its different steps, what pieces are made locally and which ones are imported. They also learned about the advantages and the challenges involved in this business.

Mr. Al-Sadee is a trained mechanic who completed a three-year vocational training program in the 1990s near Frankfurt, Germany, at a large-scale metal manufacturing company, where he also worked for several years. After returning to Jordan, he invested his savings to establish his own feed machinery manufacturing business and imported the necessary equipment from German suppliers. This equipment is still in use today for producing various feed processing machines.

His company, Safuri, has been operating for over 30 years and currently employs three staff members. The workshop manufactures a range of feed processing equipment, including grinders, choppers, conveyor screws, feed mixers, and pelletizers. The company is capable of producing machines in various dimensions and capacities.

Figure 2:Manufaucterer shows different sieves for grinding

Mr. Al-Sadee supplies large feed companies with high-capacity grinders and mixers capable of processing up to 10 tons per hour, as well as small-scale grinders for local farmers with a capacity of approximately 1 ton per hour. The smaller grinders are priced at around USD 1,700 while the large ones are sold at about $9,000, according to Al-Saadi.

Figure 3: Local production of a feed pelletizer

However, the business has been facing declining demand and profitability, partly due to public policy constraints. Rising electricity prices and increased rental costs imposed by the local government have reduced profit margins, he indicated. Currently, the company produces only 3 to 5 grinders per month, he told the trainees.

Mr. Al-Sadee maintains strong collaboration with a nearby metal manufacturing company “Hammoudi Allobani”. He provides them with detailed specifications for the required metal sheets, including size, shape, and thickness. These specifications are programmed into specialized software connected to a laser-operated metal cutter. This precision manufacturing process enables the production of high-quality feed machinery tailored to different machine sizes and client needs.

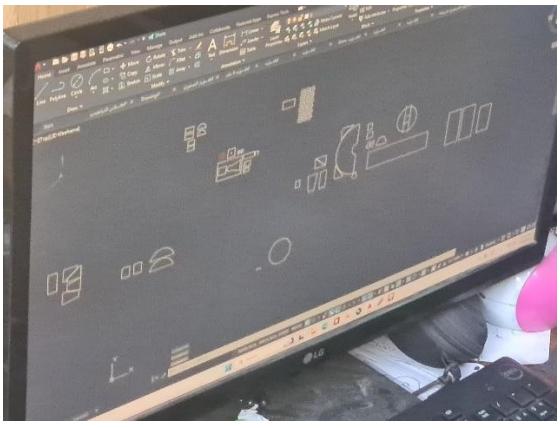

Figure 4: Digital Design and Programming for Laser Cutting

Figure 5: Laser Cutting of Metal Components for Grinders

Day 3 - Field visit to different dairy value chain actors

Feed Manufacturer

Figure 6: Participants of both training sessions "feed mechanization" and "dairy value chain" visiting feed enterprise

The participants of the second field day visited a feed-producing enterprise called **"Abu Kaiz for Feed"** in Irbid. The factory has been operating for 17 years. Mr. Abdoullah took over the business as General Manager approximately three years ago.

The enterprise employs two staff members and produces between 40 and 60 tons of animal feed per month, depending on demand from livestock farmers in the region. Farmers typically provide their own feed formulas. For example, the factory is currently producing a dairy concentrate composed of:

- 50% barley grain
- 25% wheat bran
- 12% maize grain

- 12% soybean meal
- 1% minerals and soybean oil
- Vegetable oil (could be added, according to demand)

In addition to dairy feed, the company also produces feed for small ruminants, although in smaller quantities. Poultry feed is not produced, as most large-scale poultry operations are in other regions of the country.

Figure 7: Grinded and mixed Dairy Feed

Figure 8: Livestock feed processing and stocking

Mr. Abdoullah is a trained agricultural specialist and provides advisory services to farmers on livestock management. The company sources wheat bran and barley from public silos, where these commodities are subsidized by the government. Maize and soybeans are procured through feed importers. According to Mr. Abdoullah, milk production has declined in recent years due to low farm-gate milk prices. Locally produced fresh milk faces strong competition from imported milk powder

Dairy Shop

Figure 9: Dairy shop in Irbid, Jordan selling fresh milk, yogourt, ghee, cheese, sour milk and butter

The dairy shop **"Said Dairy"** in Irbid was visited as another key actor in the dairy value chain. The small business is owned by the son of a dairy farmer, who established the shop to add value to locally produced milk.

Due to low milk prices, he processes the milk into yoghurt, ghee, butter, cheese, and sour milk. However, the economic returns from this value addition remain limited, as electricity (particularly for cooling) and water costs have increased significantly in recent years. The price of the local liquid milk is below the desired level because of the competition from great deal of imported powder milk, according to the store owner.

He currently sells fresh milk at 0.4 JD per liter and yoghurt at 1.4 JD per liter. Without public sector support, such as subsidies, he indicated that he may be forced to close the dairy business in the near future.

Dairy Farm

Figure 10: Trainees at the farm

Figure 11: Dairy cows at the farm

Figure 12: Maize silage in bags and mixed forages between olive trees

A nearby dairy farmer, who is a regular client of the feed-producing enterprise “Abu Kaiz for Feed,” was also visited. The farmer owns 20 dairy cows in addition to calves. The average daily milk production per cow is approximately 26 liters.

In addition to feed concentrates, he provides fresh fodder grown between his olive trees, mainly consisting of a mixture of barley and local grasses and legumes. He also purchases maize silage in bags.

Unfortunately, there is no recycling system for the plastic silage bags; they are either burned or buried, posing environmental concerns.

Day 4 - Review, Knowledge Assessment, and Training Evaluation

The fourth and final day of the Small-Scale Feed Mechanization Training of Trainers (ToT) focused on reinforcing the knowledge gained over the previous days, assessing participants' learning progress, and concluding the program with feedback and evaluation. The day's activities included a review of field visits and theoretical content, a quiz to test participants' understanding, a hands-on agroecological card game, and the final evaluation of the training.

i) Revision of the Two Field Days

The morning session began with a revision of the two field days, during which participants visited feed machine manufacturers, steel processing companies, feed processing companies, dairy processors, and livestock farmers in Jordan. The review provided an opportunity to discuss key observations and insights gained from the field visits. Participants shared their reflections on the practical applications of the technologies and approaches they had seen, and how these could be adapted and implemented within the Yemeni context. This segment fostered a rich exchange of ideas and ensured that the field experiences were fully integrated with the theoretical knowledge gained earlier in the training.

ii) Revision of the First Day (Theory)

Following the field day revision, the trainer revisited the key theoretical concepts covered on the first day. This included:

- **Introduction to Small-Scale Feed Mechanization:** Participants revisited the definition, scope, and types of feed processing equipment discussed during the initial theoretical session.
- **Business and Technical Considerations:** Emphasis was placed on raw material sourcing, feed formulation basics, and operational management challenges.
- **Financial and Organizational Models:** Participants also reviewed the investment costs, financing options, and organizational structures suitable for feed mechanization projects.

This revision aimed to consolidate participants' understanding of the theoretical content and ensure that key concepts were clearly understood before the assessment.

iii)) Agroecological Card Game

As part of the interactive learning activities, participants engaged in an agroecological card game designed to reinforce their understanding of good agricultural practices and their relevance to sustainable feed and livestock systems.

The game consisted of 32 cards, each representing a specific good agricultural practice, such as crop rotation, composting, mulching, fodder chopping, improved animal housing, vaccination, water harvesting, and integrated pest management. These practices were grouped into eight thematic areas, including soil fertility, crop protection, animal health, water management, feed and fodder production and small-scale farm machinery.

The trainer first presented and explained all 32 practices, highlighting their practical relevance and potential application within the Yemeni context. Particular emphasis was placed on how these practices complement small-scale mechanization and contribute to resilient and sustainable farming systems.

Following the presentation, participants were divided into two groups to play the card game. The objective of the game was to collect four cards belonging to the same thematic area (a "quartet") by requesting specific cards from other players. Through strategic questioning and exchange, participants aimed to complete as many quartets as possible. The player that collected the highest number of quartets was declared the winner.

Beyond its competitive aspect, the game served as an effective learning tool. It encouraged participants to recall and categorize agricultural practices, stimulated discussion on their practical implementation, and strengthened teamwork and communication skills. The activity created an engaging learning environment while reinforcing key agroecological concepts relevant to feed mechanization and sustainable livestock production.

Figure 13: Participants playing and enjoying agroecological card game

5. Assessment and evaluation

Quiz with 25 Revision Questions

To assess the knowledge gained over the course of the training, a quiz consisting of 25 revision questions was administered to the participants. The quiz was similar in format to the one given on the first day, allowing the trainer to measure participants' retention and understanding of the content. The questions covered a broad range of topics, including:

- Types of feed processing equipment
- Feed formulation and raw material sourcing
- Financial considerations and business models
- Key technical and operational aspects of feed mechanization

The quiz provided valuable insight into each participant's progress and areas where further clarification might be needed.

Participants' mean scores increased from 16 / 25 (SD = 2.38) before the course to 22.14 /25 (SD = 1.77) after completion. The improvement of 6.14 points was statistically significant ($t(5) = 5.48$, $p = 0.001$), confirming a clear and substantial gain in technical and practical knowledge.

Discussion of Correct Quiz Answers

After completing the quiz, the trainer facilitated a group discussion of the correct answers. Participants were encouraged to ask questions, clarify doubts, and provide explanations of their own reasoning behind the answers. This interactive session helped reinforce correct knowledge and address any misconceptions or gaps. It also served as a valuable opportunity for peer learning, as participants shared their perspectives and experiences related to each question.

Training Evaluation and Distribution of Certificates

The final session of the day focused on the evaluation of the entire training program. Participants were asked to complete a feedback form, where they rated various aspects of the training, including:

- Relevance and clarity of content
- Quality of the trainer's delivery
- Usefulness of field visits and practical demonstrations
- Opportunities for interaction and peer learning
- Overall satisfaction with the program

Participants rated the training workshop very positively across all evaluation criteria. All criteria were rated 5 / 5 (excellent) by all seven participants. The following comments were given to the respective evaluation questions:

Q and A: Please state the three most important ideas /concepts that you learned from course?

- How to manufacture, install, and maintain machinery.
- Understanding different types of feed production machinery (choppers,pelletizers).
- How to mix and produce concentrated animal feed.
- Preparing feed mixtures for dairy cattle and sheep fattening.
- Basics of calculating income and investment returns.
- Estimating slaughter yield and profitability when renting feed processing machines.
- Gained practical knowledge in feed mixing techniques and machinery use.

Q and A: Suggestions for future improvement of the course?

- Extend the training duration to at least one week (7 full days).
- Increase the number of facilities included in the visits.
- Allocate one day for tourism outside the training program.
- Including training in modern and updated machinery.
- Ensure sufficient time for trainees to fully understand the content and gain meaningful outcomes.

Q and A: Any other comments?

- The training course was excellent and very well delivered.
- The course was successful, and we gained significant knowledge despite the cold weather.
- The course was very useful and informative; however, the duration was short, and it should be extended to more than one week.

The feedback collected was invaluable for improving future training sessions and ensuring that participants' needs were met effectively.

Following the evaluation, participants were presented with their **Certificates of Completion**, formally recognizing their successful participation in the Small-Scale Feed Mechanization ToT. The certificates were a token of appreciation for their commitment and contribution to the program.

Conclusion

Day 4 of the training program was an important opportunity to consolidate the knowledge gained throughout the course, assess the participants' learning progress, and ensure that the objectives of the training were met. Through a combination of revision, knowledge assessment, and hands-on activities, the day concluded with a positive reflection on the learning journey and the successful completion of the program.

By the end of the day, participants had acquired the necessary tools, knowledge, and confidence to return to Yemen and share their newly gained skills with their communities. The final evaluation indicated high levels of satisfaction, with participants expressing appreciation for the comprehensive, hands-on nature of the training, as well as the practical insights gained from the field visits.

The program has successfully achieved its objective of equipping Yemeni stakeholders with the knowledge and skills needed to implement small-scale feed mechanization technologies, contributing to improved livestock productivity and sustainable rural development in Yemen.

Annex 1: Course Agenda

1. **Day (10 February 2026)**

Time	**Activity**
8h30 – 9h00	Arrival and registration of the participants
9h00 - 9h30	- Introduction to the training / objectives - Presentation of participants - Pre-evaluation
9h30 – 10h00	Module 1: Understanding Small-Scale Feed Mechanization (including types of equipment, videos)
10h00 – 10h30	Module 2: Business opportunities for farmer organization (incl case studies from Tunisia and Mali) – revision questions Module 1 and 2) -
10h30 – 11h00	*Coffee break*
11h00 – 12h30	Group work on feed business development (business plan)
12h30 – 13h30	*Lunch*
13h30 - 14h00	Presentation and discussion of group work
14h00 – 14h45	Module 3: Technical and operational considerations
14h45 - 15h00	*Coffee break*
15h00 – 16h00	Module 4: Financial & Organizational Aspects -revision questions Module 3 and 4 -

2. **Day (11 February 2026)**

Time	**Activity**
9h00 – 15h00	Visit one small-scale feed machine manufacturing enterprises and one metal processing enterprise

3. **Day (12 February 2026)**

Time	**Activity**
9h00 -13h00	Visit one animal feed producing company, a dairy shop and a dairy farm
13h00 - 1700	Free time / visit Amman

4. **Day (13 February 2026)**

Time	**Activity**
9h00 – 12h30	-Revision in working groups, lessons learned, assessment and evaluation, Handing over certificates; agroecology card game
Afternoon / Evening	Return to Yemen

Annex 2: Detailed evaluation results

	5	4	3	2	1	N/A	Final Scoring
The training course is relevant to my job	7						5
The subject matter of the training was understandable	7						5
The objectives of the course were clearly communicated	7						5
The level of the lectures was appropriate	7						5
The time allocated for discussions was appropriate	7						5
The possibilities for interaction with participants enrolled in the course was appropriate	7						5
Overall, how would you rate this course	7						5
The time allocated to lectures was appropriate	7						5
The lectures were useful	7						5
The time allocated to the technical field/lab visits was appropriate	7						5
The technical field/lab visits were useful	7						5
The use of teaching aids was effective	7						5
The teaching materials and presentations were clear	7						5
The handouts and additional material provided were useful	7						5
Pre-course communication	7						5
Travel arrangements	7						5
Quality of the accommodation	7						5
Payment of allowance on time	7						5
Transportation	7						5
Comfort and suitability of the lectures rooms	7						5

Trainer Name								
Udo Rudiger		5	4	3	2	1	N/A	Final Scoring
	The trainers had command over the subject	7						5
	The trainers managed to keep me interested throughout the training	7						5
	The trainers were open to ideas and suggestion of trainees	7						5
	The trainers managed their time effectively	7						5
	The clarity of speech was evident	7						5
	The language used by the trainers was appropriate regarding the impact on learning	7						5
	The quality of the trainers' presentations and teaching materials was of high standard	7						5