# GEAVET TRAINING PROGRAMME FOR CSA

## LIVESTOCK SMART SKILLS AND CLIMATE-SMART POST-HARVEST PROCESSING:

# UGANDA

## UNIT I.2 HYDROPONIC FODDER PRODUCTION

**ENGLISH VERSION**

**GEAVET Project n° 101129027**

Open Educational Resources

# PART I – LEARNING MATERIAL

## 1. Introduction

Globally, agriculture provides a livelihood for more people than any other industry. Growth in agricultural production and productivity is needed to raise incomes for everyone, to support the increasing numbers dependent on the industry and to meet the food and raw material needs of the faster growing urban populations everywhere in the world (Alston and Pardey, 2014).

In Uganda, agriculture is the largest economic sector, accounting for 43% of Gross Domestic Products (GDP) and 80% of employment. Most industries and services in the country are based on this sector and approximately 90% of total merchandise exports consist of agricultural products. Food accounts for 47% of GDP of which 56% is from subsistence. It is estimated that only one third of total food produced is marketed (Gollin and Rogerson, 2010).

Enhancing agricultural productivity contributes to industrial growth by providing cheap labour, capital investment, foreign exchange and markets for manufactured consumer goods. Agriculture has a key role in reducing poverty since most of the world's poor live in rural areas and are largely dependent on agriculture, while food prices determine the cost-of-living for the urban poor. About half of the total poor live in South Asia, and half the remainder in Sub-Saharan Africa, with smaller numbers in the rest of the developing world.

Livestock provide over half of the value of global agricultural output and one third in developing countries. Livestock contribute to rural livelihoods, employment and poverty relief. They integrate with and complement crop-production, embody savings and provide a reserve against risks (Said, 2021).

With the world development strategies in the framework of sustainable development goals, livestock products consumption and their market demand is steadily progressing, leading to adaptation of diversifying into different technological methodologies of livestock feed production for sustainable, efficient, animal welfare purposes as well as meeting market demand needs of livestock products worldwide.

Such technological methodologies of livestock feed production include hydroponic fodder, precision nutrition and formulation, automated feed manufacturing systems, fermentation and bioprocessing, genetic and biotechnological enhancements among others.

In this particular training unit we shall look at Hydroponic fodder as one way of the technology adapted to, to increase livestock feed.

## 2. Hydroponic Fodder

Hydroponic fodder is a type of livestock feed produced by germinating seeds in a hydroponic system. Hydroponic fodder is an exciting and unique way of growing grass. It is a process that uses water to grow grass rather than soil whereas fodder is food given to livestock, particularly cattle, horses, chickens, and sheep.

The hydroponic fodder used as livestock feed is young, tender grass grown from cereal grain, mostly barley which must be rich in nutrients, making it a nutritious and healthy diet for livestock. In addition, no soil is required for the hydroponic fodder system, which nurtures the grass in a nutrient-rich solution.

Adopting hydroponic fodder is a progressive approach to constructing robust and effective livestock production systems in the face of changing agricultural demands and international issues. This method offers a remedy for the lack of green feed during dry seasons, livestock feeds sustainability options, efficiency, animal welfare and limited supply of livestock demanded products in the world market.

### 2.1. Categories of Hydroponic Fodder

There are two major categories of fodder; permanent and temporary, and all these categories, each has its own types.

**Temporary fodder:**

a) **Grasses, including cereals:** Grass hydroponic temporary fodder is a fast-growing, soil-free green feed produced from sprouted grains like barley or maize, typically harvested within 6–7 days to nourish livestock. There are step by step production processes of hydroponic grass fodder and these include: seed selection, soaking, tray setup, spreading seeds, watering and light, growth monitoring and harvesting.

b) **Legumes, including pulses:** Legumes are plants from the *Fabaceae* family that produce pods containing seeds, while pulses are the dried edible seeds from these pods—such as beans, lentils, and peas. Its step by step production process is: seed selection, pre-soaking, tray preparation, spreading seeds, watering and environment control, growth monitoring and harvesting.

c) **Root crops:** This is a temporary type of the hydroponic fodder where root vegetables like beets, carrots, or turnips are grown hydroponically (without soil) to produce fresh, nutrient-rich feed for livestock. However, this practice is rare and experimental compared to grain-based hydroponic fodder. Its step by step production process is; selection of root crop species, seed preparation, tray setup, planting, watering and nutrient, supply lighting and environment control, growth monitoring and harvesting.

d) **Trees:** Tree temporary hydroponic fodder is where the fast-grown tree species, especially their leaves or shoots, “are cultivated in a controlled, soil-free environment to produce short-cycle green feed for livestock” though this is an emerging concept and not widely practiced. Such trees of this type of fodder are *Leucaena, Moringa, Gliricidia, or Sesbania*, all their leaves known to be high in protein content. Its step by step production process is: species selection, seed or cutting preparation, tray or system setup, planting and spacing, watering and nutrient management, lighting and environmental control, growth monitoring and harvesting.

**Permanent hydroponic fodder:** This is where the land is used for five years or more for herbaceous forage crops. This system may also include some portions of forest land if used for grazing. In permanent production, the preparation process is similar to temporary fodder.

### 2.2. Benefits of Hydroponic Fodder

a) **Hydroponic is high in nutrient content:** Hydroponic fodder is rich in essential proteins, vitamins, minerals, which significantly enhances the health and productivity of livestock. Such vitamins are A, E, C, B1 (thiamine), B2 (riboflavin), B3 (niacin), B7 (biotin) as well as rich in folic acid, anti-oxidants like β-carotene and minerals.

b) **Digestibility:** The fodder is highly digestible promoting better nutrients absorption and leading to increased production of high -quality milk production.

c) **Cost effective production:** Hydroponic fodder can be grown in a controlled environment, reduced dependence on imported forage and it minimises production costs. It allows farmers to produce feeds locally hence cost effective.

d) **Reduce water usage:** The system requires significantly less water compared to traditional fodder production. 3-4 litters of water are needed to grow 1 kg of hydroponic fodder to 70-100 litters for conventional methods.

e) **Sustainable practice:** Hydroponic fodder systems can be implemented with minimal environmental impact, as they do not require soil and are free from pesticides and herbicides. This leads to healthier livestock and reduces the ecological footprint of farming operations.

f) **Year-round availability:** Unlike traditional fodder, which can be affected by weather conditions and seasonal changes, hydroponic fodder can be produced throughout the year, ensuring a consistent supply of fresh feed.

g) **Space efficiency:** Hydroponic systems can save up to 90% of land usage compared to traditional farming methods, making them ideal for areas with limited agricultural space.

h) **Labor efficiency:** These systems often require less labour to maintain since they can be managed with fewer resources.


**Figure 1. Hydroponic fodder production process** (Ashwin, 2025)

### 2.3. Hydroponic fodder system requirements

Below is the list of the hydroponic requirements which must be observed by anyone involved in the production of fodder by hydroponic system, whether at business or subsistence purpose levels: space and infrastructure, environmental conditions, seeds and germination, water and nutrient management, maintenance and monitoring, system types and scale, livestock feeding considerations (Ghorbel et al., 2022).

## 3. Hydroponic case studies for Europe and Uganda learners, educators and farmers

Generally, European farmers have embraced hydroponic fodder as a high-tech, sustainable supplement in precision livestock systems, while Ugandan farmers approach it more cautiously, often constrained by cost, awareness, and infrastructure. In Europe, hydroponic fodder feed production has a positive reception most especially in countries like the Netherlands, Germany, and Switzerland, this because of their climate-controlled kind of agriculture practice. It is common primarily in dairy and beef

operations to improve feed quality and reduce dependency on imported or weather-sensitive forage, integrated into automated systems with sensors, climate control, and nutrient dosing, embraced as the sustainable solution to reduce land use, water consumption, and carbon footprint and extremely supported by government subsidies and research programs hence promotion of Agri-tech innovation, where as in Uganda hydroponic fodder is still promising and experimental, with adoption mostly among urban or peri-urban farmers. This is characterized by limited awareness, high initial set up costs, inconsistent water access and electricity and comparisons with traditional forage. However, some urban livestock keepers, especially poultry and dairy are exploring the system.

The Government of Uganda is also eyeing hydroponic fodder, through the Ministry of Agriculture by promoting hydroponics as part of its Smart Agriculture strategy, aiming to engage youth in innovative farming practices for increased productivity as an alternative source of income. Ugandan learners and educators are increasingly viewing hydroponic fodder as a forward-looking agricultural innovation, though its adoption is still in early stages. With more training, support, and localized success stories, it has the potential to become a mainstream tool in youth-led farming.

Institutions like Bishop Stuart University based in Mbarara city in western Uganda have incorporated hydroponic fodder into student research and coursework, including studies on its impact on cattle growth and meat quality. However, learners in agricultural colleges and vocational schools are being introduced to hydroponic systems as part of smart farming and climate-resilient agriculture. Hydroponics Farms Uganda is also currently offering practical training for youth and students on how to grow hydroponic maize and sorghum fodder using local materials.

## 4. Fodder production opportunities and enterprise establishment

Livestock in Uganda, like in many other parts of the world, is mainly grazed on natural grass-based communal pastures found within land-use systems that include forests, woodlands, swamps and fallow lands. Many of the pasturelands located in land use systems are declining due to continuous conversion of land for agricultural and settlement activities (NEMA, 1998). Feeding of livestock in natural pastures is therefore becoming a challenge and is partly limiting development in the livestock sub-sector. It is clear that there is high demand for fodder on the market but supply is insufficient, while women and youth continue to face high rates of unemployment.

Youth and women tapping opportunities in forage production and its value chain, supported by access to land, productive resources, quality information, technical support, networking, and inclusive business models for forage and seed production, offer a clear pathway to increased fodder productivity, higher profits, and dignified employment (Mangnus, 2019).

It is estimated that Small and Medium-sized Enterprises (SMEs) in Uganda constitute 90 percent of the private sector, with 80 percent being located in urban areas and, are largely involved in trade, agro-processing, and small manufacturing (Hategа, 2007): SMEs contribute approximately 75 percent of the gross domestic product (GDP) and employ approximately 2.5 million people, signifying their importance in the economic development of Uganda (Et al., 2008).

With this background therefore promoting positive attitude towards youth enterprise in hydroponic fodder production paves the way for youth to address unemployment scourge, hence this curriculum unit is important for youth in SSA countries.

## 5. References


Amuka, A. Y. (2019). *Automatic monitoring and control of hydroponic fodder system*

Ashwin S. (2025). Step-by-Step Guide to Setting Up Your Hydroponic Fodder System. https://www.scientifichydroponics.com/2025/08/15/step-by-step-guide-to-setting-up-your-hydroponic-fodder-system/

Ghorbel R. H. O. U. K. A. Y. A., & Koşum, N. (2022). Hydroponic fodder production: an alternative solution for feed scarcity. In *6th International Students Science Congress Proceedings* (pp. 1-9).

Gumisiriza, M. (2023). *Status, physiognomies and economic viability of hydroponic lettuce production in selected areas of Southern TANZANIA and Central UGANDA* (Doctoral dissertation).

Gumisiriza, M., Kabirizi, J., Mugerwa, M., Ndakidemi, P., & Mbega, E. (2022). Can soilless farming feed urban East Africa? An assessment of the benefits and challenges of hydroponics in Uganda and Tanzania.

Hassen, A., & Dawid, I. (2022). Contribution of hydroponic feed for livestock production and productivity: a review. *Int. J. Ground Sediment Water*, *15*(1), 899-916.

Matos, J., Gonçalves, J. S., & Torres, M. B. (2015). An automatic mechanical system for hydroponics fodder production. *The Romanian Review Precision Mechanics, Optics & Mechatronics*, *47*, 63-71.

Odero, J. (2023). *An Assessment of Hydroponics Farming Technology in Urban and Peri-Urban Areas of Nairobi City, Kenya* (Doctoral dissertation, University of Nairobi).

## PART 2 – CURRICULUM

### Learning Objectives:

| KNOWLEDGE | SKILLS | ATTITUDES |
|---|---|---|
| *Students will know:*<br>● Different ways of producing fodder without planting directly into the soils.<br>● Alternative ways of producing livestock feed in the most limited time and space.<br>● Know the requirements of hydroponic fodder processes.<br>● Nutritional values of fodder.<br>● Nutrient solution preparation.<br>● Types of hydroponic systems available.<br>● Environmental control like understanding of regulating and balancing of the temperatures, humidity and light, how they affect the growth.<br>● Procedures of enterprise establishment. | *Student will be able to:*<br>● Set up a system and maintain it<br>● Acquire presentation skills<br>● Record keeping and data analysis<br>● Acquire resource management skills<br>● Have waste management skills<br>● Monitor crops and harvesting.<br>● Control water quality<br>● Acquire nutrients management skills<br>● Select seed for quality germination<br>● Online business name registration | *Student will develop the following mind-set:*<br>● Knowledge sharing and transfer<br>● Innovation oriented mind set<br>● Problem solving mindset<br>● Environmental and ethical attitudes.<br>● Social and entrepreneurial attitudes<br>● Lifelong learning attitudes such curiosity and openness to learning new things and data driven thinking for other challenges tackling |
| **TRANSVERSAL SKILLS INTEGRATED:** | | |

- **Adaptability**
- **Communication skills**
- **Problem solving**
- **Organizational skills**

**DIGITAL SKILLS INTEGRATED:**

- **Search engine optimisation skills:** To support them in creating searchable content without paying for the service
- **Digital content marketing:** Creating the materials that attract potential customers and increase online traffic for business access such as blogs, videos, etc.
- **Video conferencing:** To acquire skills for conducting video and audio meetings
- **E-mail creation and use digital skills**

**GREEN SKILLS INTEGRATED:**

- **Water Conservation Techniques**
- **Climate-Smart Agriculture**
- **Sustainable Livestock Management**
- **Waste Reduction and Circular Farming**
- **Technical and Entrepreneurial Skills**
- **Monitoring and Data Logging**
- **Agri-entrepreneurship**
- **Environmental and Social Impact Awareness**
- **Eco-literacy**
- **Community Engagement**

## Implementation plan of pedagogical activities - Scheme of work

| Duration: 3 hours | | | | | |
|---|---|---|---|---|---|
| Target: Women Farmers, entrepreneurs, VET learners, small holder farmers, | | | | | |
| **No of Activity** | **Duration** | **Activity** | **Training Method** | **What the trainers do** | **What the participants do** |
| 1. | 25 min | Introduction to Agriculture;<br>Livestock indicating their | • Brain storming<br>• Discussion | • Trainers shall be interacting with trainees | • Trainees shall be tasked by the trainers to while in the group to |

| | | | | | |
|---|---|---|---|---|---|
| | | relationship to economic growth and the impact of climate smart agriculture integration | ● Flip chart stands and flip chart and markers<br>● Projector with Power Point presentations<br>● Question and answer | and through the presentations | brainstorm benefits of agriculture, livestock and how climate smart agriculture interventions like hydroponic practices promote economic growth. |
| 2. | 60 min | Introduction of hydroponic system of agriculture, hydroponic fodder technological method of feeds production as an adapted way under climate smart agriculture, its categories, types and benefits in general | ● Brain storming<br>● Flip chart stands and flip chart and markers<br>● Projector with Power Point presentations<br>● Question and answer | ● Trainers shall be interacting with trainees and present-ting | ● Trainees shall be participating in the presentations and actively engaged by the trainers<br>● The trainees shall be tasked to produce a simple hydroponic seed selection and watering. |

| | | | | | |
|---|---|---|---|---|---|
| 3. | 30 min | Hydroponic fodder system requirements and a visit to the site of hydroponic fodder practicing farmers or videos showing hydroponic fodder preparation processes and production | ● Brain storming<br>● Flip chart stands and flip chart and markers.<br>● Projector with Power Point presentations<br>● Question and answer.<br>● Demonstration | ● Trainers shall be interacting with trainees and present-ting | ● Trainees shall be asked through internet search, in groups of 5, to look for hydroponic fodder production videos, watch them and thereafter, group representatives present to the rest of the groups the benefits of practicing hydroponic fodder production by farmers or any entrepreneur.<br>● Participants shall too be guided by the host expert/farmer, entrepreneur to produce hydroponic fodder simple structure. |
| 4. | 30 min | Hydroponic fodder system case studies in Europe and Uganda learners, | ● Brain storming<br>● Flip chart stands and | ● Trainers shall be interacting with trainees and | ● Trainees shall be participating in the presentations and actively engaged by the trainers |

| | | | | | |
|---|---|---|---|---|---|
| | | educators and farmers. | flip chart and markers<br>● Projector with Power Point presentations<br>● Question and answer | present-ting | through asking them to brainstorm areas known for production of hydroponic fodder in Uganda |
| 5. | 35 min | Fodder production opportunities and enterprise establishment | ● Group discussion<br>● Internet search<br>● Group presentations | ● Trainers shall ask the participants in their groups to form business names.<br>● The trainers and external expert shall show the participants how to reserve business names with Uganda Registrar service bureau (URSB) | ● The participants shall in their groups after supported by the trainers and experts to explore how to reserve the business name and register for Tax identification number, be asked to make name reservation and TIN registering tests on both URSB and Uganda Revenue Authority portals |

**Materials, tools and equipment (What the trainers need to have prepared):**

- Power point presentations/handouts/visuals
- Flip chart stand and flip chart
- Markers
- Masking tapes
- Sticker note books
- Projector and connectors
- Feedback evaluation forms/links
- Attendance registration forms
- Internet connectivity
- Wood
- Bow saw
- Polyethylene papers gauge 2000
- Tack nails
- BRC mess medium
- Sorghum seeds
- Water and watering can

# PART 3 – ACTIVITY GUIDE

# DESCRIPTION OF THE ACTIVITIES

## 1. Introduction to Agriculture; Livestock

This activity shall look at what agriculture is in general. It shall mention the percentages of people and livestock depending on agriculture for their survival both in terms of food security and social economic growth of the communities' livelihoods and their livestock. This shall be related to the livestock values and roles toward development of the wellbeing of the communities and indicate the need of adapting or integrating of the climate smart agriculture to purposely address the challenges that might affect the agricultural outputs in this era of climate change.

**1. Aim of the activity:**

Showing the participants, the values and the roles of agriculture and livestock and the impact of the integration of climate smart agriculture toward economic development.

**2. Duration:** 25 minutes

**3. Material, tools and equipment required:**

- Projector
- Power point presentations,
- Flip stand chart,

- Flip chart and markers
- Internet and connectors
- Evaluation forms or google doc links.

**4. Step-by-step instruction of the task/practical exercise/case study:**

➢ The trainers shall guide the participants and be able to brainstorm and discuss values and roles of agriculture, livestock and inclusion of climate smart agriculture in socio-economic development of Uganda.

➢ At the end of the sessions, the trainer shall ask the participants to evaluate the day's training activities.

**References/Sources/Further materials:**

Finella, L. D. (2025). Current state of agriculture in Uganda: Problems and ways to solve them.

Ndahura, M. (2023). *Evaluating physical agricultural research infrastructure development in Uganda: a case of the National Agricultural Research Organization* (Doctoral dissertation, Makerere University).

## 2. Introduction of hydroponic system of agriculture, hydroponic fodder technological method of feed production as an adapted way under climate smart agriculture, its categories, types and benefits in general

The activity shall define the hydroponic system of agriculture in general and hydroponic fodder production as well as climate smart agriculture. The method of feed production shall be defined as one way of climate smart agriculture adopted to address land scarcity, reducing feed costs and scarcity and overcoming resource constraints. Trainers shall also look at how each of the above terms; agriculture, hydroponic system technology, fodder, livestock and climate smart agriculture, complement each other's impact and their self-impact requirements, roles and values. The activity also shall look at categories of hydroponic fodder systems, types and their step by step processes and benefits.

**1. Aim of the activity:** Introducing the hydroponic system of agriculture, hydroponic fodder production technology and their connection to climate smart agriculture as a best practice for addressing food, income and resources scarcity challenges. Also to make sure the participants get to know hydroponic fodder production categories, types, benefits and requirements

**2. Duration:** 30 minutes

**3. Material, tools and equipment required:**

- Projector
- Power point presentations

- Flip stand chart
- Flip chart and markers
- Different varieties of seeds
- Water and watering can
- Internet and connectors
- Evaluation forms or google doc links.

**4. Step-by-step instruction of the task/practical exercise/case study:**

- ➢ The trainers also engage participants in the discussion groups of defining hydroponic agriculture, hydroponic fodder and climate smart agriculture and their relationship.
- ➢ Participants brainstorm categories of hydroponic fodder, types, requirements and benefits.
- ➢ Participants shall in organized groups search for information about hydroponic categories, types, requirements and benefits and then be tasked to present them. The trainer shall ask the participants to prepare their power point presentations and amongst themselves.
- ➢ The participants shall be accessed with different seeds and select the best for the fodder production and be able to carry out watering.
- ➢ The trainer shall through video links show the participants how hydroponic fodder production is done. https://www.youtube.com/watch?app=desktop&v=f1OYag_LUvA&sttick=0, https://www.youtube.com/watch?v=AopJOvT0i6M
- ➢ Trainers shall ask the participants to evaluate the day's training activities.

**References/Sources/Further materials:**

Amuka, A. Y. (2019). *Automatic monitoring and control of hydroponic fodder system* (Doctoral dissertation, Busitema University.).

Bekuma, A. (2019). Nutritional benefit and economic value of hydroponics fodder production technology in sustainable livestock production against climate change-A mini-review. *Advances in Applied Sciences*, *4*(1), 23-25.

Chethan Babu, R. T., Magan Singh, P. B., Chethan Patil, N. D., & Birendra Kumar, M. (2022). Hydroponics fodder production: A climate smart approach for sustainable green fodder. *Basics of Climate-Smart Technologies of Fodder Production and Conservation*, 283.

Ghorbel, R. H. O. U. K. A. Y. A., & Koşum, N. (2022). Hydroponic fodder production: an alternative solution for feed scarcity. In *6th International Students Science Congress Proceedings* (pp. 1-9).

Gebremedhin, W. K. (2015). Nutritional benefit and economic value of feeding hydroponically grown maize and barley fodder for Konkan Kanyal goats. *IOSR J. Agric. Vet. Sci*, *8*, 24-30.

Kannan, M., Elavarasan, G., Balamurugan, A., Dhanusiya, B., & Freedon, D. (2022). Hydroponic farming–A state of art for the future agriculture. *Materials today: proceedings*, *68*, 2163-2166.

Salo, S. (2019). Effect of Hydroponic Fodder Feeding on Milk Yield and Composition of Dairy Cow. *Journal of Natural Sciences Research*, *9*(8), 1-2.

Shit, N. (2019). Hydroponic fodder production: an alternative technology for sustainable livestock production in India. *Exploratory Animal & Medical Research*, *9*(2).

Sousa, R. D., Bragança, L., da Silva, M. V., & Oliveira, R. S. (2024). Challenges and solutions for sustainable food systems: The potential of home hydroponics. *Sustainability*, *16*(2), 817.

## 3. Hydroponic fodder system requirements

For this activity the trainer shall make sure that his/her power point presentations contain the hydroponic fodder system requirements (space and infrastructure, environmental conditions, seeds and germination, water and nutrient management, maintenance and monitoring, system types and scale, livestock feeding considerations). Each and every requirement must be elaborated and demonstrated by visiting hydroponic fodder, practicing farmers or using the video resource links shown on the projector screen so that the participants are able to understand all the requirements.

**1**. **Aim of the activity:** Showing and providing the hydroponic fodder preparation processes and its requirements (both theory and practical information) to the targeted women farmers.

**2. Duration:** 60 minutes

**3. Material, tools and equipment required:**

- Projector
- Power point presentations
- Flip stand chart
- Flip chart and markers
- Bow saw
- Hammer
- Wire mesh (mosquito net type)
- BRC
- Polythene paper (DBM type 2000 gauge) 4 poles 15 feet each

- Tack nails a quarter inch
- Watering can
- Seeds
- Water
- Internet and connectors
- Evaluation forms or google doc links.

**4. Step-by-step instruction of the task/practical exercise/case study:**

- ➢ The trainers also engage participants in the trainer lead discussions groups to brainstorm hydroponic fodder system requirements and be jotted down.
- ➢ The trainers shall have organized the trip to the hydroponic fodder practicing farmers before the training, 2 days before.
- ➢ The groups shall visit any hydroponic fodder practicing farmer or company and with the support of the host farmer or hydroponic fodder production practitioner be able to prepare a local simple hydroponic infrastructure. Four simple wood poles of eucalyptus trees of 15 feet each, 5" nails 1kg, polythene paper (dpm type 2000 gauge), tack nails, one and a quarter inch, wire mess (mosquito type and BRC medium, water, watering, can, hammer, bow-saw) shall be organized prior to the visiting the site.
- ➢ Participants shall through the guidance of the host hydroponic fodder practitioner make a simple hydroponic fodder production structure and processes.
- ➢ At the end of the sessions, the trainer shall ask the participants to evaluate the day's training activities.

**References/Sources/Further materials:**

Gunasekaran, S., Bandeswaran, C., & Valli, C. (2019). Low-cost hydroponic fodder production technology for sustainable livestock farming during fodder scarcity. *Current Science*, *116*(4), 526-528.

Hassen, A., & Dawid, I. (2022). Contribution of hydroponic feed for livestock production and productivity: a review. *Int. J. Ground Sediment Water*, *15*(1), 899-916.

Naik, P. K. (2014). Hydroponics green fodder for dairy animals. *Recent Advances in Animal Nutrition*, *403*, 191-210.

Naik, P. K., Swain, B. K., & Singh, N. P. (2015). Production and utilisation of hydroponics fodder. *Indian Journal of Animal Nutrition*, *32*(1), 1-9.

Stone, M. (2014). *Simple Guide on Hydroponics Gardening: Expert Tips for Beginners and Intermediate Gardeners*. Martha Stone.

Turakne, S. S., Jondhale, S. B., Vikhe, P. M., & Gore, M. N. (2021). Hydroponics Fodder Grow Chamber. *International Journal of Scientific Research in Science, Engineering and Technology. https://doi. org/10.32628/ijsrset2183177*.

## 4. Hydroponic fodder system case studies in Europe and Uganda learners, educators and farmers

The trainer shall make sure that in his/her power point presentations there contains hydroponic fodder system practices comparing the system integration and best practices in different regions of Europe and Africa, most specially Uganda. Examples from the specific countries from each content shall be presented under the 3 situations of learners, educators and farmers. Case study of video practices responses, motivations and challenges at three different case study situations of learners, educators and farmers in relation to practicing hydroponic shall be sited out in the trainers' power point presentations and presented before the trainees or participants.

Using videos from Europe and SSA, comparisons of farmers, learners and educators shall be made in relation to how each actor responds to hydroponic fodder production agricultural practice.

**1. Aim of the activity:** Presenting different responses of two different continents (Europe and Africa, Sub Saharan countries, Uganda case study) about hydroponic fodder within the learning, education and farming systems.

**2. Duration:** 30 minutes

**3. Material, tools and equipment required:**

- Projector
- Power point presentations
- Flip stand chart
- Flip chart and markers
- Internet and connectors
- Evaluation forms or google doc links.

**4. Step-by-step instruction of the task/practical exercise/case study**

➢ The trainers through power point presentations shall present different hydroponic responses of different specific countries in Europe in the areas of learning, education and farming practices, in comparison with Uganda responses in the same hydroponic fodder.

➢ The trainer shall present examples of some of the hydroponic practices from learners, educators and integrating hydroponic fodder practices in the education system and farmers practicing the same on their farms.

- ➢ The participants shall, through a plenary session, be organised to discuss the importance of adopting hydroponic fodder farming by the women farmers, entrepreneurs, VET institutions etc.

**References/Sources/Further materials:**

Gabiri, G., Luswata, K. C., Sebuliba, E., & Nampijja, J. (2022). Climate Smart Agriculture in Uganda.

Kyomugisha, C. (2018). Effect of climate-smart technologies on smallholder farmers' resilience to climate change.

Malabadi, R. B., Kolkar, K. P., Chalannavar, R. K., Coronado, K. V. C., Mammadova, S. S., Baijnath, H., & Abdi, G. (2024). Greenhouse farming: Hydroponic vertical Farming-Internet of Things (IOT) Technologies: An updated review. *World Journal of Advanced Research and Reviews*, *23*(02), 2634-2686.

## 5. Fodder production opportunities and enterprise establishment

In this activity, the participants shall be supported by the trainers and the external expert to understand how fodder production is a potential activity economically and how to adventure into it as an alternative source of income generation. They will also be supported in how to reserve the names with Uganda Registrar Service Bureau (URSB) and registering of Tax identification numbers with Uganda Revenue Authority (URA) on both portals of URSB and URA. The activity shall support the participants through non-formal ways to create business names, logos and pooling resources together.

**1. Aim of the activity:** To show the participants how fodder production can be alternative sources of employment moreover in the limited space and introduce to them the simplest and cheapest pathways of establishing the business, formation of business names and logos as well as acquiring tax identification number

**2. Duration:** 35 minutes

**3. Material, tools and equipment required:**

- Internet
- Projector
- Websites
- Markers
- Flip charts.

**4. Step-by-step instruction of the task/practical exercise/case study:**

- ➢ The trainers shall through video links show how fodder production generates income to different categories of people, most probably, the video links should be sited from SSA countries.
- ➢ The expert in generating Tax Identification numbers (TIN), shall take through the participants in the process of generating TIN.
- ➢ The expert in business name reservation shall take through the participants the steps involved to reserve the business name.
- ➢ The trainer shall too, through simplest way (non-formal methods) support the participants to create logos of their desired business initiatives.
- ➢ The participants shall be asked without the support of the trainers and experts generate TIN and reserve the business names and at the end of the sessions, the trainer shall ask the participants to evaluate the day's training activities.

**References/Sources/Further materials:**


Kaleel, D. M., & Ali, E. H. (2024). Economic Feasibility Study for the Project of Cultured Barley Production with Hydroponic Method. *Iraqi Journal of Agricultural Sciences*, *55*(Special), 233-245.

Kisaakye, P., Nzabona, A., Kakuba, C., Asiimwe, J. B., Mushomi, J., Tuyiragize, R., & Wandera, S. O. (2021). Youth migration and perception on business start-up in Uganda. *Journal of Global Entrepreneurship Research*, *11*(1), 255-268.

Kumar, V., Singh, A. K., & Pandey, H. C. (2018). Estimation Of Business Potential in Sorghum Fodder and Seed Production. *Plant Archives*, *18*, 137-140.

Maina, K. W., Baltenweck, I., Lukuyu, B. A., Teufel, N., Mwendia, S., van Mourik, T. A., & Peters, M. (2021). Assessment of the forage seed sector in Kenya and Uganda. *International Livestock Research Institute, Nairobi, Kenya*.

Okello-Obura, C., Minishi-Majanja, M. K., Cloete, L., & Ikoja-Odongo, J. R. (2008). Sources of business information and means of access used by SMEs in Uganda: the case of Northern Uganda. *Library and Information Science Research E-Journal*.

Omollo, E. O. (2017). *Analysis of fodder production and marketing in the rangelands of southern Kenya* (Doctoral dissertation, University of Nairobi).

Tabuti, J. R., & Lye, K. A. (2009). Fodder plants for cattle in Kaliro District, Uganda. *African Study Monographs*, *30*(3), 161-170.

Uddin, M. T., & Dhar, A. R. (2018). Socioeconomic analysis of hydroponic fodder production in selected areas of Bangladesh: Prospects and challenges. *SAARC Journal of Agriculture*, *16*(1), 233-247.