The photo shows barley fodder being grown on the trays in a shelter. (Babirye Sarah)

Barley fodder management for livestock production among smallholder farmers (Uganda)

Balle

DESCRIPTION

Barley fodder technology is a livestock feed that grows under a hydroponic system. This green feed is highly palatable, rich in protein and energy yet cost-effective. It takes few days to maturity (5-6 days) and can be grown in a smaller area. One kilogram of barley seeds can yield up to 6 to 6.5 kg of green feed.

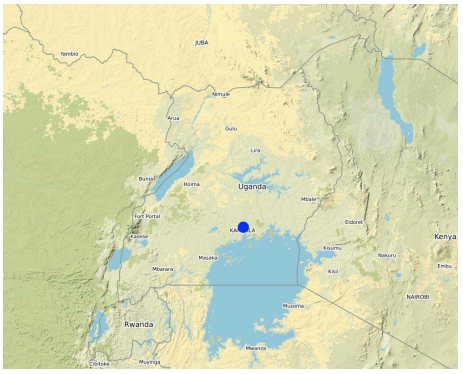
Barley is a cereal grain that grows with hydroponic system to supplement on the feeds for livestock. This system enables crops to grow without soil so easily yet they mature within the shortest time in a smaller area. It is commonly used in finishing rations for livestock. Barley sprouts the best, grows the fastest and is cost-effective. This green feed is less expensive yet highly palatable and nutritious for animals.

To work well for sprouted fodder, the barley seed needs a high germination rate. Sprouting barley consistently and economically needs a climate-controlled space, light (18 hours of light and 6 hours of darkness) and a watering system. The ideal temperature being 75 degrees F and 70% humidity. Air movement is necessary to control mold.
The technology ensures a reduction of pesticides and herbicides because the plants are in a protected environment . The sprouts are high in protein and fiber, and are naturally balanced in protein, fat and energy. Barley fodder has 95% of the energy and higher digestibility hence reducing the occurrence of digestive diseases, such as bloat. It is one of the most nutritious sprouts and is full of essential nutrients, vitamins and minerals. These are absorbed more efficiently due to the lack of enzyme inhibitors in sprouted grain. Dry barley seeds yields between 6-6.5kg of green feed. Feeding barley fodder will improve the overall health and wellbeing of animals. With this technology, farmers can easily anticipate the expected amount of feeds. Despite the benefits, growing barley requires skills, knowledge and constant supervision especially maintaining the conditions required. Barley seeds are at times hard to get. In case of commercial/large livestock farming, the technology is not economically feasible. Bacterial and fungal growth is also another challenge like the common bread mould therefore seeds must be sterilized. The steps taken to grow barley seeds are as follows:

•On day 1, the barley seeds are laid on plastic trays after being soaked in water for 8-12 hours or an overnight. These seeds must be moist and kept clean. In case of any moulds, hydrogen peroxide may be used in the soaking water to kill mould.
•On day 2, the trays are placed on shelves where they are stacked. On this day, initial sprouting begins. Seeds must be kept moist, but not water-logged. Manually, water should be spread every after 4-5 hours. The seeds will usually sprout within 24 hours.
•On the third day, initial shooting begins. Watering still proceeds.
•From the 4-5th day, the root mat or the mat stem begin to grow.
•On the 6-7 the day, the farmers begins to harvest the barley grass and gives to the livestock. The grass has produced a 6-8 inch high grass mat with a 2 inch mat of interwoven roots.

The sprouted grain is harvested by removing the tray or sliding the mat off the tray in one long sheet. The mats can be cut to the appropriate size and fed to animals. Livestock will eat the whole thing like seeds, roots, and grass therefore, there is minimal waste. Barley is a major feeding option when pastureland and/or hay are in short supply, or adds a highly nutritious and relished supplement to traditional grazing.
Initial costs involved to a small scale farmer are minimal. This includes buying clean seeds, 5 kg costing 15,000/=, 10 plastic trays (50000), 2 watering cans (20000), 1 bucket for soaking seeds (10000), watering seeds 6 times (18000), soaking seeds (3000), labour for making shelves (30000), papyrus mat (20000) ,2 kg of nails (10000), timber for making shelves (50000), chopping ready folder (3000) totalling to 232,000/= for a start. However, this depends on the amount of fodder a farmer wants to produce.

LOCATION



Location: Kyanja, Gayaza, KAMPALA, Uganda

No. of Technology sites analysed: single site

Geo-reference of selected sites
- 32.59331, 0.4015

Spread of the Technology: applied at specific points/ concentrated on a small area

Date of implementation: less than 10 years ago (recently)

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☑ during experiments/ research
- ☐ through projects/ external interventions

A kg of barley seeds yields to 7-10 kg of green fodder. Each kg of fodder is sold at 1500 hence in a kg planted (i.e. 3000 invested), a farmer is likely to earn 15000/=
The technology is advantageous in that there is little or insignificant costs involved on maintenance of the technology. Maintenance only involves daily watering of seeds (18000 for 6 days), cleaning the treys after use (3000) and supervision on barley during growing for 6 days (18000) totaling to 39000/=.

The photo above explains the stages involved while growing barley grass.Source:(Growing Sprouted Fodder For Livestock by Jason Wiskerchen Monday, March 19, 2012 (Babirye Sarah)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [ ] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [x] create beneficial economic impact
- [ ] create beneficial social impact

Land use

Other - Specify: Laboratory
Remarks: The demonstration was done at Kyanja National Research Organization in a laboratory.

Water supply

- [ ] rainfed
- [x] mixed rainfed-irrigated
- [ ] full irrigation

Number of growing seasons per year: n.a.
Land use before implementation of the Technology: n.a.
Livestock density: n.a.

Purpose related to land degradation

- [ ] prevent land degradation
- [ ] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [x] not applicable

Degradation addressed

other -

SLM group

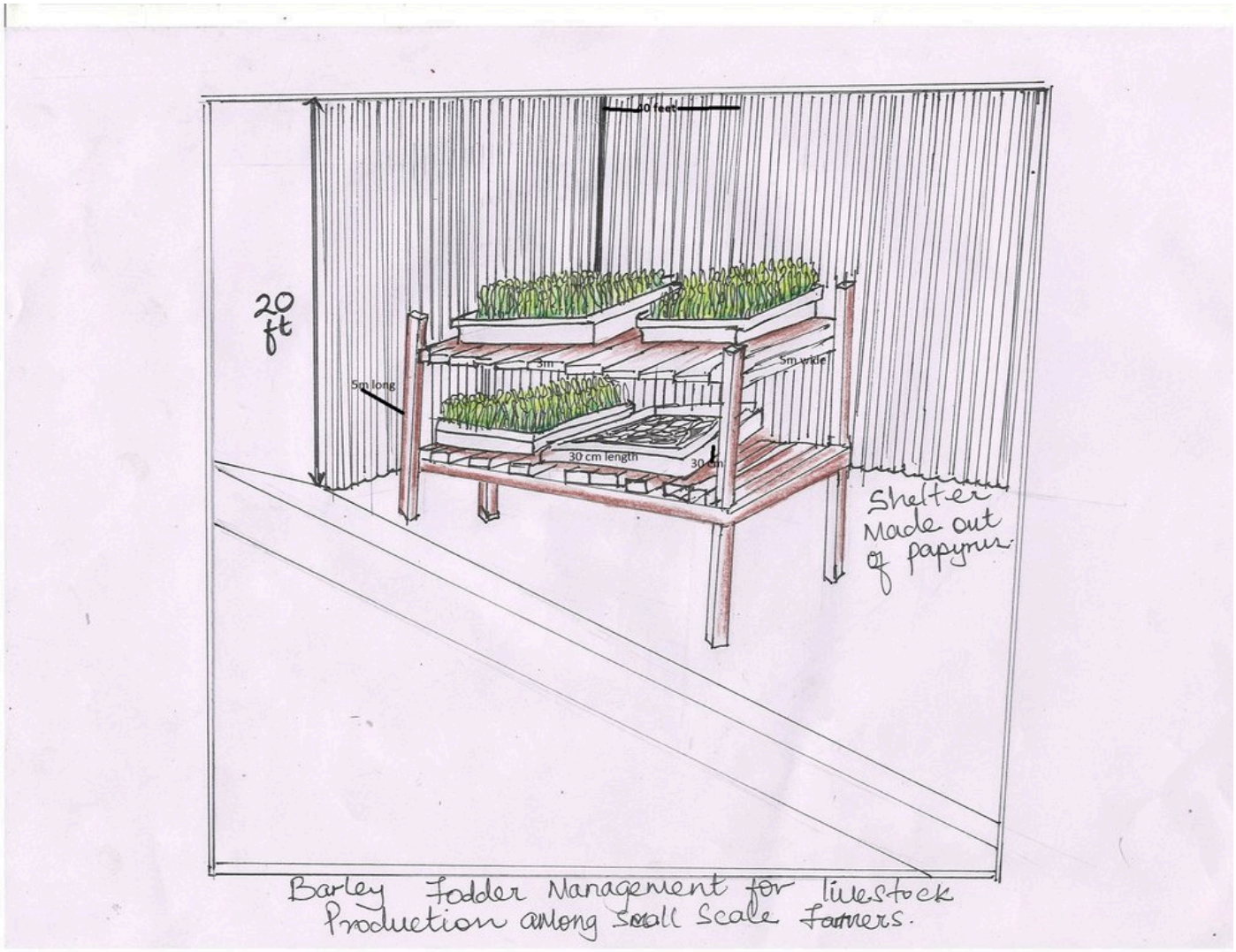
- integrated crop-livestock management
- minimal soil disturbance

SLM measures

management measures - M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications



Author: Prossy Kaheru
The shelter is constructed at 20 feet long and 20 feet wide
Trays(10) of 30cm wide and 30 cm length
Barley seeds (5kg)
Shelves (20) of 3m wide and 3m long
Papyrus mats (2) of 20 feet wide and 40 feet long
Shelves stand of 5m long

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit
- Currency used for cost calculation: **UGX**
- Exchange rate (to USD): 1 USD = 3600.0 UGX
- Average wage cost of hired labour per day: 3000/= per day

Most important factors affecting the costs

Labour costs represent the largest cost element.

Establishment activities

1. Buying seeds (Timing/ frequency: Every planting time)
2. Clean the seeds if dirty to avoid molds (Timing/ frequency: Before planting if they are dirty)
3. Soak the seeds for 8-12 hours (Timing/ frequency: 8-12 hours)
4. Place the trays on the shelves (Timing/ frequency: Once from 1-5 day)
5. Water the seeds planted on the tray every 4-8 hours (Timing/ frequency: 4-8 hours for 5 days after planting)
6. Harvest and chop the leaves,stems and roots,then give to the livestock (Timing/ frequency: After harvesting)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (UGX)	Total costs per input (UGX)	% of costs borne by land users
Labour					
Making shelves	Man day	1.0	30000.0	30000.0	
Clean the seeds if they are dirty	Man day	1.0	3000.0	3000.0	
Soaking the seeds into water	Man day	1.0	3000.0	3000.0	
Chop the fodder ready for feeding	Man day	1.0	3000.0	3000.0	
Equipment					
Water the seeds planted on the trey in every 4-8 hours	Man day	6.0	3000.0	18000.0	

Buying trays	piece	10.0	5000.0	50000.0	
Plant material					
Buying seeds	Kg	5.0	3000.0	15000.0	
Buying a watering can	piece	2.0	10000.0	20000.0	
Buying a bucket	piece	1.0	10000.0	10000.0	
Construction material					
Timber making shelves	piece	5.0	10000.0	50000.0	
Nails	Kg	2.0	5000.0	10000.0	
Papyrus mats	piece	2.0	10000.0	20000.0	
Total costs for establishment of the Technology				**232'000.0**	

Maintenance activities

1. Watering the seeds (Timing/ frequency: Every day after planting to harvest)
2. Maintaining the room temperature (Timing/ frequency: Every day after planting to harvest)
3. Replacing poles (Timing/ frequency: Once a year)
4. Cleaning the equipments like treys (Timing/ frequency: After harvesting)
5. Replacement of shelves (Timing/ frequency: Once a year)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (UGX)	Total costs per input (UGX)	% of costs borne by land users
Labour					
Watering seeds	Man day	6.0	3000.0	18000.0	
Cleaning the equipments(trays)	Man day	1.0	3000.0	3000.0	
Equipment					
Spervision of the growing barley	Man day	6.0	3000.0	18000.0	
Total costs for maintenance of the Technology				**39'000.0**	

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [x] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone

- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate

n.a.

Slope

- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [x] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms

- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude

- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [x] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in

- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth

- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)

- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)

- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content

- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table

- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water

- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)

- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?

- [ ] Ja
- [x] Nee

Occurrence of flooding

- [ ] Ja
- [x] Nee

Species diversity

- [ ] high
- [x] medium
- [ ] low

Habitat diversity

- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [x] employee (company, government)

Gender
- [ ] women
- [x] men

Age
- [ ] children
- [x] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [x] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [x] leased
- [ ] individual

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [x] leased
- [ ] individual

Access to services and infrastructure

health	poor	good
education	poor	good
technical assistance	poor	good
employment (e.g. off-farm)	poor	good
markets	poor	good
energy	poor	good
roads and transport	poor	good
drinking water and sanitation	poor	good
financial services	poor	good

IMPACTS

Socio-economic impacts

fodder quality

decreased — increased

Improves on fodder for animals. That is 1 kg of barley yields 7-10 kg of green fodder

animal production

decreased — increased

The animals that feed on barley supplements reduced suffering from bloating because of high digestibility

farm income

decreased — increased

Barley grass is highly nutritious with a lot of protein content. Coupled with being a very palatable fodder, the growth rate of animals increases.

Socio-cultural impacts

health situation

worsened — improved

The health situations of animals is improved. Barley fodder has 95% of the energy and higher digestibility hence reducing the occurrence of digestive diseases, such as bloat. It is one of the most nutritious sprouts and is full of essential nutrients, vitamins and minerals.

Ecological impacts

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

CLIMATE CHANGE

Climate-related extremes (disasters)

drought	not well at all	very well
insect/ worm infestation	not well at all	very well
Too high temperature	not well at all	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [ ] single cases/ experimental
- [ ] 1-10%
- [x] 10-50%
- [ ] more than 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- [ ] 0-10%
- [x] 10-50%
- [ ] 50-90%
- [ ] 90-100%

Has the Technology been modified recently to adapt to changing conditions?

- [x] Ja
- [ ] Nee

To which changing conditions?

- [x] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

It is operated in a moist, cool environment

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- It is less cost effective yet highly nutritious. A kg of barley is nutritionally equivalent to 3Kg of other grass like the lucerne.
- Barley grows in a very short period of time
- It requires a small piece of area to grow barley

Strengths: compiler's or other key resource person's view

- Barley improves the overall health and well-being of animals
- It has higher digestibility hence reduces on some diseases like bloat
- Barley growing does not involve the use of soil hence cost effective

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- The technology requires skills and knowledge especially to manage the conditions for growth Encouraging farmers to train from model farmers
- Barley seeds are at times hard to get. Promoting the barley seed multiplication in large quantities
- The technology requires maximum supervision Always endeavor to do maximum supervision

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Bacterial and fungal growth is also another challenge e.g the common bread mould. Seeds must be sterilized
- Barley is not economically feasible for large scale farmers on pasture production To grow more pastures in addition to barley as feed supplements
- It cannot be stored for a long period of time Serve it in the first days after harvest.

REFERENCES

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Resource persons
Fred Kabanda - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_3453/
Video: https://player.vimeo.com/video/261459678

Linked SLM data
n.a.

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Key references
- Growing Sprouted Fodder For Livestock by Jason Wiskerchen Monday, March 19, 2012,: https://www.peakprosperity.com/growing-sprouted-fodder-for-livestock-2/

Links to relevant information which is available online
- https://www.hydroponics-simplified.com/hydroponic-fodder-advantages.html: http://www.fodderconsultants.com/advantages.html