Module 1

Agronomic Aspects of Agricultural Lending

Training Manual

Training notes

Module objective

The objective of this manual is to provide technical information on agricultural crops and livestock activities with the aim of increasing knowledge of agricultural loan officers and staff of Centenary Bank. This knowledge will help agricultural loan officers to distinguish good farmers from bad farmers and identify risks early on in the process.

The target group of this module consists of agricultural loan officers, credit managers and branch managers.

Mode of delivery

This training manual is accompanied by a **PowerPoint presentation** that follows the sequence of the manual. The style is interactive. The module foresees in a field day where students will visit one or more farms and/ or nurseries; and in an exercise in income/ revenue analysis.

Mode of assessment

- Students can be assessed based on a written test if this is desirable. Alternatively they can be assessed on their interaction during classes.
- Trainer to be evaluated based on Centenary form for this purpose.

Reference material

- Materials from NARO

Time line

Our estimate is that this module can be taught in two days including the field day.

CONTENTS

List of Acronyms

Abb.	Full text
AEW	Agricultural Extension Worker
ASN	Ammonium Sulphate Nitrate – a fertilizer
DAP	Di Ammonium Phosphate – a fertilizer
FYM	Farm Yard Manure
GoU	Government of Uganda
NPK	Nitrogen, Phosphorus, Potassium (K) – a fertilizer
OPV	Open Pollinated Varieties
PH	Post-Harvest
PHH	Post-Harvest Handling
Soil pH	Acidity of the soil – level 3-7 is acidic, above 7 is alkaline
Shs	Ugandan Shillings
SP	Super Phosphate – a fertilizer
UCOP	Unit Cost of Production
Urea	Fertilizer, mainly adding Nitrogen to the plants
WFP	World Food Program

1. Introduction

1.1 Content of the manual

This manual presents key information on the following crops and activities:

- Maize
- Robusta and Arabica Coffee
- Rice
- Banana
- Sunflower
- Dairy & beef farming
- Poultry farming – egg and meat production

These crops and activities represent the vast majority of agricultural production in Uganda. Specific information on technical aspects of agricultural production is given for each of the above crops/ activities, such as climatic and soil requirements, production calendar and yield indications. Finally, an income/ revenue analysis of the farming activity is given under three different scenarios: traditional, low input and high input. Each distinct crop/ activity represents one chapter.

Traditional
As the word indicates, the traditional scenario is based on ancient, traditional farming practices without taking advantage of any modern farming methods, insights or inputs.

Low input
Low input farming refers to a scenario where the farmer applies limited fertilizer, makes limited use of high yielding varieties but does apply some modern techniques.

High input
High input farming relates to modern, state-of the art farming techniques with optimal use of high yield varieties, fertilizer, weed and pest control etc.

1.2 Linking product Income/ Revenue Analysis to agricultural loan analysis

For the avoidance of doubt, Centenary Banks's agricultural loan analysis methodology, focusing on establishing future repayment capacity of an agricultural household with the help of a projected cash flow shall remain the basis for all agricultural production loans. This training module's product-based income/ revenue analysis shall be complementary to it and not act as a substitute.

What income/ revenue analysis does demonstrate is the profitability of a certain activity. It is partial analysis which helps better understand the costs and incomes associated with certain activities. As a general rule, each farming activity should be profitable in its own right but loan officers may come across situations where seemingly unprofitable activities are carried out – to feed the family, or to make use of an abundant production factor such as labour. Note that labour is factored in as a cost in a cost/benefit approach. However, many farmers may use their

own labour or family labour for activities such as weeding, which are costs but not necessarily expenses.

It is important that, especially for larger projects/ loans, the activity or activities to be financed are sustainable and profitable. For that reason it is recommended to carry out an income/ revenue analysis for every loan above […] Uganda Shillings.

The income/ revenue included here are obviously examples of likely scenarios. Assumptions have been made on quantities and prices of inputs (including labour), yields and prices of produce.

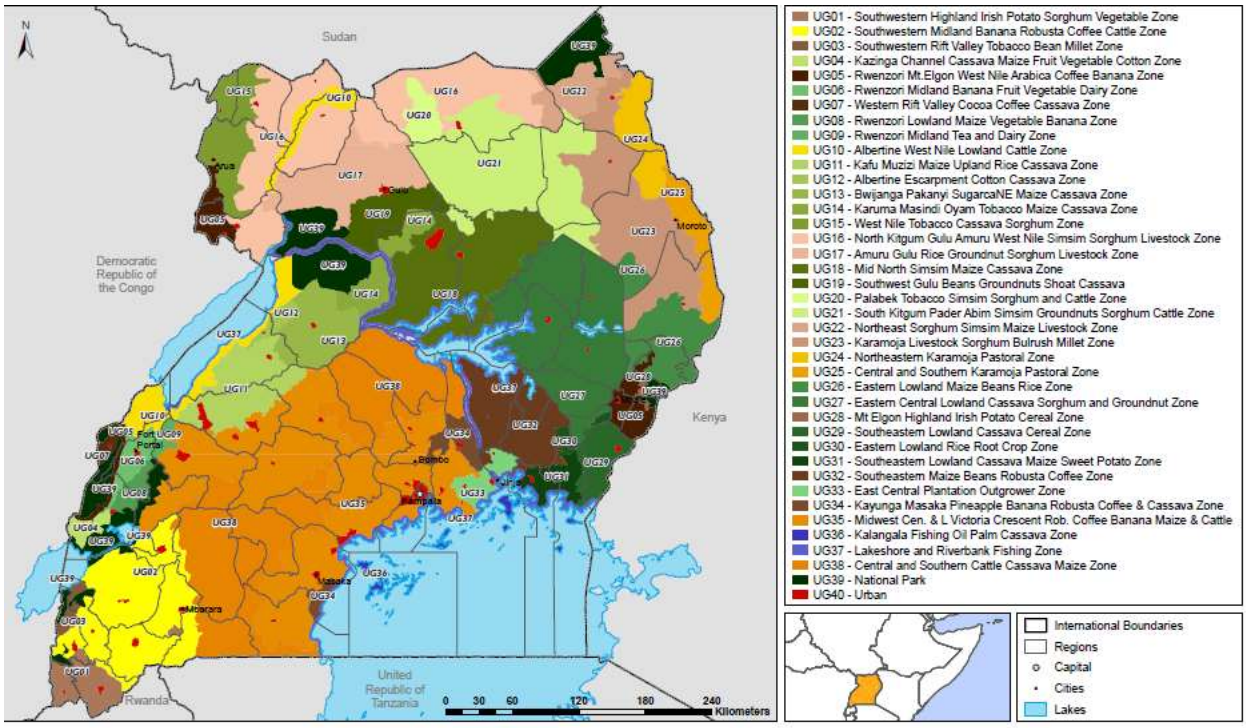
1.3 Interpretation of yields and prices in this manual

Best estimates are used for yields and prices. These are not meant to be used in the calculations of the agricultural loan analysis methodology. Rather, when constructing the cash flow of a borrower to determine his/ her repayment capacity, use the farmer's historical yields and very conservative price estimates.

1.4 Agricultural production/ livelihood zones

Uganda has a large variety of agricultural production/ livelihood zones, as can be seen from the map below. However there are some dominant zones such as the

- Ug35: Midwest Robusta coffee, banana maize and cattle zone;
- Ug27: Eastern Cassava, sorghum and groundnut zone.



2. Maize

Background
Maize is one of the world's most important cereal crops. In East Africa, the crop is a major staple food for a large section of the population, in addition to being an important animal feed. Maize was mostly used as a food crop for domestic consumption but after 1981 the Government of Uganda began to export it to neighbouring countries like Kenya. Much of the maize produced in Uganda is now procured by the World Food Program for its aid activities.

Climatic and soil requirements
Maize can be grown on a wide range of soils in Uganda, although it does best on soils that are well drained, deep and loamy, and well supplied with organic matter. Fertilizer application is thus highly recommended to greatly improve maize yields. Maize does not do well in swampy areas that are water logged or in sandy soils. The optimal soil pH should range between 6.0 and 7.0.

Major areas of production
Maize can be grown in most, if not all, parts of Uganda. It is often intercropped with beans.

Land preparation
The land on which maize it is planted should be ploughed at least twice to kill all the weeds and loosen the soil. The land should be prepared at the end of the last rains to allow for breaking down of crop residues during the dry season. The seedbed should be fairly rough to facilitate infiltration and reduce erosion.

Time of planting
Over 98% of agriculture in Uganda is rain-fed. The planting of maize in Uganda is done according to the two rainy seasons i.e. mid Feb-June and mid-Aug –December. However, rainy seasons have changed a lot over the years and it is no longer possible to predict the onset of rains accurately.

Planting
The depth of planting depends on the soil moisture content. In wet/moist soils, the seeds should be planted 2-3cm below the ground. If the soil is dry, the planting hole should be 5-10cm deep so that it can germinate only when there's enough rain. The seed rate for maize is 25 kg/ha or 10kg per acre.

Spacing
The purpose of planting maize in rows is to ensure better utilization of the land as well as facilitating easier weeding and spraying. The spacing should be 75cm x 30cm (one seed per hole) or 75cm x 60cm (2 seeds per hole).

Weed control
As a crop, maize is most susceptible to weed competition during the first month. If weeds are not well controlled during this time, the yields will fall drastically. The weeds can be controlled mechanically by hand weeding or by use of chemicals (pre- and post-emergent herbicides). Herbicides like Lasso-atrazine or Alazine may be used.

Fertilizer application

Two types of fertilizer are generally recommended for maize:

Urea – applied as a top dressing 3-4 weeks after planting by sprinkling it between rows at a rate of 125-350 kg/ha. The plot should be thoroughly weeded before applying the fertilizer. A hand hoe should be used to cover the fertilizer lightly to prevent volatization.

DAP (Di-Ammonium Phosphate)–Applied to the soil at the time of planting at a rate of 50kg per acre (100 – 125 kg/ha). Approx. 3-5g (one heaped soda bottle top) in the bottom of each planting hole should be applied and covered with a light layer of soil before planting to avoid burning of the seed.

Major pests

Maize Stalk Borer – affects the stalk of maize plants by boring through it to weaken the plant and make it susceptible to breakage.

Control – it can be controlled by using locally registered insecticides applied to funnels of the plants when the crop is knee high. Application rates are usually 4-6 kg per Ha. Only a few granules per plant are required.

Major diseases

Maize Streak Virus - causes yellow stripes in the plant and badly affects yield. Longe 1 and the new Uganda hybrids are fairly resistant, but some Kenya hybrids are sensitive to this disease in the low-mid altitude areas. The pressure of this disease is much lower in the highlands because the leafhopper that spreads the disease is much less active.

Control - In general, use of improved seed, good crop rotation use and application of hygiene measures such as burying or burning old crop residue can be effective in checking a host of other maize diseases.

Field drying and harvesting

Maize can be stored for considerable period in unprocessed form without undergoing deterioration. It can be left in the field and on the plant provided pest and diseases, humidity, ambient temperature, and moisture content of grain is relatively low. Harvest should take place when stalks have dried and moisture of grain is about 17-20%. The crop is left on the plant for up to 8 weeks to dry down. This method has the disadvantage of increasing infestation by insects and fungi as well as damage by birds. Field losses can easily be greater than 20%. Up to 80% of storage problems come from late field harvesting.

Drying and storage

After harvesting, the greatest enemy of grain is moisture. Wet grains attract insects and moulds. Therefore the grain must be dried as soon as possible after harvesting. The preferred low cost method of drying sizeable quantities of maize (cobs) is by use of cribs constructed in such a way as to allow free movement of air through. They should be raised at least 1 meter off the ground and not more than 1.5 meters in width. The height including clearance off the ground should not exceed 3.1 meters, with a roof overhang on either side [made preferably of mabati] of 0.5-0.75 meters. The crib length can then be adjusted to quantity of grain for drying and temporary storage. The safe level of moisture of maize for long storage is usually 12%-15.5%.

Production calendar

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Land preparation												
Seed acquisition												
Planting												
Weed control												
Fertilizer application												
Pest and disease control												
Harvesting												
Post harvesting handling												

Maturity and yields

Official name	Days to maturity	Yield range (Kg/acre)
Longe 1	115-120	1600 - 2400
Longe 4	100 – 105	1600 - 2400
Longe 5 (Nalongo)	115	2800 - 3200
Longe 6H	120	3200 - 3600
Longe 2H	125	2800 - 3200

Income/Revenue Analysis

Activity	**Traditional/Subsistence (Shs/acre)**	**Low input (Shs/acre)**	**High input (Shs/acre)**
Slashing	17,000	17,000	17,000
Round-up			25,000
Spraying			7,000
First ploughing	30,000	70,000	70,000
Second ploughing		70,000	70,000
Seed	6,000	45,000	45,000
DAP			60,000
Rope		3,000	3,000
Planting	9,000	15,000	20,000
First weeding	30,000	30,000	30,000
UREA			55,000
Top dressing			8,000
Second weeding	30,000	30,000	30,000
Harvesting	9,000	20,000	29,000
Transporting home	9,000	20,000	29,000
Drying	5,000	13,500	18,000
Shelling	9,000	22,000	31,000
Bags	7,200	14,900	22,200
Total Cost (Shs)	**201,200**	**370,400**	**569,200**
Yield (Kg/acre)	**750**	**1,700**	**2,800**
UCOP (Shs/Kg)	**268**	**218**	**203**
Farm Gate Price (Shs/Kg)	**350**	**350**	**350**
Gross Income (Shs)	**262,500**	**595,000**	**980,000**
Net Income (Shs)	**61,300**	**244,600**	**410,800**

3. Robusta coffee

Background
Coffee remains the most important cash crop in Uganda. Robusta coffee accounts for 60-70 percent of total coffee exports. Coffee also provides employment and cash income for a large number of people in the coffee growing areas of Eastern, Central and Western Uganda.

Commercial varieties
Varieties include the Erector, local Nganda and clonal Robusta coffee. The latter is developed through selection and crossbreeding between Erector and Nganda. Clone refers to plants that are raised or multiplied through vegetative propagation.

Major Robusta coffee growing areas
Areas include mainly low-altitude (800-1200 m above sea level) areas of Central, Eastern, Western, and South-eastern Uganda.

Soil and climatic requirements
Robusta coffee is a vigorous plant that can grow on a variety of soils. Best soils, however, are average loamy soils of good texture and rich in organic matter with pH of 5.3-6.0. Soils should be deep and well drained but capable of retaining water. Coffee requires evenly distributed rainfall (900 – 2000mm per annum) with average annual temperature of 24-26^{o}C.

Planting/ spacing
Land should be prepared at least 6 months before the planting date. Planting holes should be dug 3 months before planting. The size of the fairly round hole should be 3ft (1m) in diameter and 3ft (1m) deep. Topsoil should be placed on one side and sub soil on the other side. One tin of well-rotted manure should be mixed with subsoil in each planting hole. The hole should be filled one month before planting. Subsoil should be applied at the bottom of the hole first, followed by topsoil mixed with manure.

Without intercropping, coffee plants should be spaced at 10ft by 10ft (3.3m x 3.3m) and a population of 444 coffee trees per acre (1,100 coffee trees per hectare) will be realized.

Weed control
Newly planted fields should be kept free of weeds to avoid competition for water and nutrients, which can delay the time for harvesting the crop. Recommended weed control methods include manual weed control (hoeing, slashing, hand pulling) and chemical control using herbicides like Roundup.

Herbicide application
Weeds should be slashed to ensure that the weeds are not more than 6 inches before spraying. Manual weeding or glyphosate (Roundup) should be used to kill weeds in the coffee garden.

Mulching
Mulching helps to conserve soil moisture, adds nutrients and also keeps down the weeds. For young coffee, mulching within the canopy of the plants is sufficient. Mulching materials include dry grass and other crop residues including banana leaves and stems. The use of coffee husks

should be avoided (risk of transferring diseases) and it should be ensured that the mulching material does not touch the base of the young plants.

Pruning
Coffee pruning is critical for good production as it rejuvenates the plant through removal of unproductive wood. The number of stems should be limited to 3-4 because a higher number will lead to decreased productivity. De-suckering or the removal of unwanted suckers should be done several times a year. Pruning should be done at the end of the main crop after harvest by making use of a pruning saw, not a panga.

Fertilizer application
As much as possible, organic manure`(farm yard/compost) should be used. Nitrogen fertilizers are also generally recommended. Calcium ammonium nitrate (CAN) should be applied at a rate of 500g per plant twice a year at the beginning of the rains together with single super phosphate (SSP). SSP should be applied only once a year unlike CAN.

Major pests
Coffee berry borer – It is the main pest affecting Robusta coffee. Its larvae bore tunnels into the coffee berries and feed on the coffee beans inside, leading to crop losses.
Control – When damage is high, Endosulfan should be sprayed on the berries at recommended rate, at least 6 weeks before harvest.

Black coffee twig borer - The black coffee twig borer (BCTB) is a small beetle belonging to the same family as the Coffee Berry Borer, but it bores mostly into primary branches and sometimes into the main stems. It kills affected branches and stems leading to considerable yield losses. Currently BCTB is devastating mainly Robusta in all the Robusta growing districts of Uganda but it is known to attack over 220 tree species, including Arabica coffee, some shade trees in coffee such as albizia spp and fruit trees such as mango, avocado other crops such as egg plants.
Control - Infested branches should be trimmed off and burnt. This should be reinforced by clean weeding to burry any infested primaries that may have remained uncollected. The infested field can be sprayed with Imaxi (Imidaclopid) insecticide at 4mls per liter in a tank mixture with Orius fungicide. Where infestation is severe (over 15%), and the coffee trees are due for change of cycle, farmers are advised to stump the coffee and burn all the stems and branches.

Coffee root mealy bugs – Found at the base of the stem. Attacked plants have drooping leaves and stunted root growth. Whitish, rubbery growth is found on the roots.
Scales and mealy bugs–These are related groups of insects which feed on sap inside the plant, affecting its growth. They form scales along the veins of the leaves, white masses (easily rubbed off) on leaves and berries, leading to yellowing of leaves and weakening of the plant.
Control - Furadan or Servin Dust should be applied.

Major diseases
Coffee wilt – This is a highly destructive fungal disease that can cause death of the plant in 2-4 weeks. It is characterized by: blackening of stem tip, wilting and rapid leaf defoliation, and premature ripening of cherry coffee.

Control

- Infested trees should be uprooted and burned

- Clean planting materials from UCDA-approved coffee nursery operators should be used
- The use of coffee husks as mulching material should be avoided
- Garden tools should be sterilized before using them in a new garden

Red blister disease – fungal disease that causes the appearance of small, raised red spots on green and ripening berries.
Control – Traditional coffee trees should be replaced with Robusta clones, as these are resistant to this disease. Spraying is not economical.

Leaf rust – This is another serious Robusta coffee disease. Symptoms include yellow-orange patches on underside of leaves, defoliation and dieback that starts at the apex.
Control – Mechanical control using regular pruning and regular weeding. Chemical control: spray using Benomyl, Mancozeb, etc.

Harvesting
The final quality of coffee depends on how well the coffee has been picked and dried. The number of harvests within a year is determined by amount of rainfall, temperature and management. With good management, there will be several harvests within the year. Areas north of the equator experience a peak harvest between September and December. For areas in the south, the peak harvest is in April or May.

Processing
Dry processing is the most commonly used method of on-farm processing of Robusta coffee. After harvesting, the coffee is spread on mats, tarpaulins or concrete surfaces so that drying takes place to form dry cherries (Kiboko). This takes about 3-4 weeks, depending on weather conditions.

Coffee production calendar

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Land clearing and preparation	■	■	■								■	■
Digging planting holes			■	■	■							
Hole filling	■	■				■	■					
Planting			■	■				■	■			
De-suckering	■	■	■	■	■	■	■	■	■	■	■	■
Stumping	■	■				■	■					
Weed control management			■	■	■			■	■	■	■	
Hoeing					■						■	■
Herbicides (Glyphosate)			■	■	■			■	■	■		
Mulching	■					■	■					■
Inorganic fertilizer application		■	■					■	■			
Harvesting peak season			■	■	■	■		■	■	■	■	
Drying				■	■	■	■		■	■	■	■
Marketing	■	■		■	■	■	■		■	■	■	■

Income/Revenue Analysis

Activity	**Traditional (Shs/acre)**	**Low input (Shs/acre)**	**High input (Shs/acre)**
Main crop			
Weeding (twice)	50,000	30,000	30,000
Mulching		160,000	160,000
Fertilizer			110,000
Fertilizer application			20,000
Pruning	25,000	25,000	25,000
De-suckering	10,000	10,000	10,000
Harvesting	35,000	50,000	130,000
Drying	15,000	25,000	25,000
Fly crop			
Weeding	30,000	10,000	10,000
Pruning	25,000	25,000	25,000
De-suckering	10,000	10,000	10,000
Fertilizer			110,000
Fertilizer application			15,000
Harvesting	15,000	30,000	75,000
Drying	6,000	14,000	14,000
Tarpaulins		20,000	20,000
Total Cost (Shs)	**221,000**	**409,000**	**789,000**
Yield (Kg/acre)	**350**	**840**	**2,000**
UCOP (Shs/Kg)	**631**	**486**	**394**
Kiboko FG price (Shs/Kg)	**1,400**	**1,400**	**1,400**
Gross Income (Shs)	**490,000**	**1,176,000**	**2,800,000**
Net Income (Shs)	**269,000**	**767,000**	**2,011,000**

4. Arabica coffee

Background
Arabica coffee was discovered in the regions of Ethiopia from where it spread to the Arabian Peninsula and was cultivated in Yemen. From Yemen, it was taken to Indonesia and other parts of the world by the Dutch who called it "Arabica" because of where they had first found it. In Uganda, Arabica coffee is a highly priced type of coffee that is grown in the mountainous regions.

Production areas
Include the high-altitude areas of eastern, western and south-western Uganda i.e., Mbale, Kapchorwa, Fort Portal, Kasese, and Kabale.

Growing conditions
Arabica is grown in tropical regions with an altitude of over 500m but preferably from 1300 to 2300m above sea level. Some 1200 – 1500mm of annual rainfall should be well distributed. The optimum temperature for Arabica cultivation is 15-24^{o}C. Arabica has a deep root system and thus requires well-drained, deep soils that are in organic matter and have a pH of 5.3 – 6.0.

Propagation
Arabica is mainly propagated using seeds selected carefully from seed trees. Seeds are planted in nursery beds and later transplanted to soil-filled plastic bags. Vegetative propagation can also be used to multiply Arabica coffee.

Land preparation
The most suitable time for soil preparation is November to February in between two rainy seasons. This will make the soil ready just before the onset of the coming rainy season during which planting can be done. Land preparation can be done mechanically although manual preparation is preferable as this will lead to less damage to the structure of the soil. All the bushes should be cleared and all stumps uprooted.

Planting/ spacing
The best time to plant Arabica coffee is from mid-March to late May. The young trees from the nursery should have 5 to 6 pairs of primary leaves and free of pests and diseases. Use a hoe to dig a planting hole of 50cm in depth and diameter. The topsoil should be placed on one side and the subsoil on the other. One tin of rotted manure should be mixed with subsoil per planting hole and the hole should be filled one month before planting. The topsoil should be put at the bottom and then followed by the mixture of subsoil and manure.

In Uganda, planting the recommended planting density varies from 1300 – 1500 plants per hectare or 500 – 600 plants per acre. Planting density is determined by soil, type, and variety. Recommended spacing is 2m between rows and x 1.5 m between plants in the row.

Weed control
The following methods are used to control weeds in coffee fields:

Hoeing: This should be done during the dry season. During the wet season, slashing can be used to keep the weeds down.

Chemical control: Involves the use of herbicides to spray weeds and kill them without affecting the coffee plants. It is always better to slash the weeds before spraying. Use glyphosate (Roundup), Touch Down etc.

Mulch: In addition to preserving soil moisture, mulch also helps to suppress weed growth by obstruction of light. The soil should be covered with 5-6 inches of mulching material, which can be grass, crop residues, or straw.

De-suckering and pruning

This is the process of removing suckers in order in order to avoid competition for nutrients on the same plant. To minimize damage, a saw or secateurs should be used to make a clean cut. Suckers should not be allowed to grow and exceed 6 ft. Pruning involves the removal of weak and old branches.

Change of cycle

After about 5-6 years, Arabica coffee stems start to become less and less productive with few primary branches. The exhausted stems should be cut and removed using a bow saw. Only one vigorous stem should be left. The centre stem should be removed first followed by another stem in the following year.

Fertilizer application

The replenishment of soil nutrients can be achieved through application of organic fertilizer (manure, compost, mulch) or inorganic fertilizer (Urea, NPK, CAN, ASN).

Fertilizer recommendation:

Tree Age (years)	Fertilizer	1ST Rain Gm/Tree	2nd Rain Gm/Tree
1-2	ASN/CAN/NPK	60	60
3-Above	CAN/UREA/NPK/ASN	200	200

Major pests

Coffee root mealy bugs

Symptoms – It lives on fruit trees like coffee. In Arabica, it affects the leaves, branches, and roots, causing the formation of a waxy substance. This causes growth retardation, lack of vigour, wilting, defoliation, and plant death.

Control – Use of clean planting materials i.e., from recognized nursery operators.

Scales

Symptoms– Includes Brown and Green Scales. Brown scales feed on sap extracted from young leaves and shoots and produce honey dew, which can attract ants and fungi resulting in a black layer covering the affected roots and shoots. Green scales appear on the leaf vein, forming sooty moulds and white masses on leaves and berries.

Control – Use of clean planting materials, pruning, and prevention of branches from touching the ground. Chemical control with malathion, Sevin Dust WP, or Thiram 50 WP.

Coffee Ants – Biting ants cause papery nests and fastening together of leaves. They make pruning, picking and cultivation of coffee difficult.
Control – Cultural practices like pruning can help to keep the canopy open for easy identification of the pests.

Coffee Stem Borer – The adults lay eggs in crevices in the bark. After 6-9 days, the larvae appear and bore into the stem of the tree. This results in wilting or even snapping at a later stage of infestation because of the tunnels. They are normally recognized as small pellets of sawdust at the foot of the tree.
Control – malathion 4/3 insecticide or cabaryl should be applied.

Major diseases
Coffee Leaf Rust – The first symptoms of coffee leaf rust are yellowy circular spots on the underside of leaves, which are covered by an orange powdery substance after about one week. The main side of the leaves shows brown (rust-coloured) spots. Severe infections cause massive leaf shedding and dieback i.e., the disease normally progresses inward from the apical point of primary branches.
Control – The use of cultural practices like weed control and pruning is recommended to remove affected parts and promote plant vigor. Spraying with the use of fungicides like Benomyl (Benlate 50WP), Mancozeb (Dithane M-45), or Thiram 50WP.

Coffee Berry Disease (CBD) – It is a very dangerous fungal disease that can cause 80% reduction in production. It normally affects fruits and branches. Leaves may remain healthy.
Control – Cultural practices like the use of CBD resistant materials, weed control and pruning. Chemical control using fungicides like Benomyl and Mancozeb may be used in cases where resistant materials are not available.

Harvesting
The handling of harvest and post-harvest activities is especially critical for Arabica Coffee as it determines the final quality of the crop and its market value. The number of harvests in a year depends on amount of rainfall, temperature and management practices. The frequency of harvests within the year can be increased with good management practices. Even then, there are two peak seasons in April-May and September-December. The coffee is harvested by selective handpicking of fully ripe cherry coffee that is neither under ripe nor over ripe. The coffee is taken to a central washing station for processing within 6-12 hours of harvesting.

Processing
The coffee is fed into a manual, hand-operated pulping machine to remove the husks and pulp. Immediately after pulping, the parchment must be spread on a drying surface (tarpaulin, concrete) to make a thickness of 2 inches (6cm). Wet parchment takes 8-12 days to reach moisture levels of 11-12%.

Income/Revenue Analysis

Activity	**Traditional (Shs/acre)**	**Low Input (Shs/acre)**	**High input (Shs/acre)**
Weeding	85,000	30,000	
Herbicide (Roundup)			32,000
Herbicide application			8,000
Mulching		100,000	100,000
Fertilizer			130,000
Fertilizer application			10,000
Pruning		25,000	25,000
Spot weeding		7,000	7,000
Trenches		15,000	15,000
Pesticide (twice)			20,000
Spraying			6,500
Harvesting	35,000	50,000	190,000
Transport	4,000	10,000	30,000
Pulping	20,000	30,200	115,000
Fermenting	8,000	15,000	50,000
Washing/sorting	17,000	26,000	92,000
Tarpaulins	8,000	8,000	18,000
Drying	8,500	15,000	53,000
Bagging materials	4,800	6,900	25,600
Total Cost (Shs/acre)	**190,300**	**338,100**	**927,100**
Yield (Kg/acre) parchment	**240**	**600**	**1,500**
UCOP (Shs/kg)	**793**	**563**	**488**
Farm gate price (Shs/kg) parchment coffee	**3,500**	**3,500**	**3,500**
Gross income (Shs)	**840,000**	**2,100,000**	**5,250,000**
Net income (Shs)	**640,700**	**1,761,900**	**4,322,900**

5. Rice

Background
As domestic rice production can no longer meet the rising demands of domestic consumption, Uganda has become heavily dependent on imports of rice. Rice is now the second or third largest food import. Upland rice (NERICA) is predominantly cultivated in Uganda compared to lowland rice, which need to be cultivated in wet fields and is common in Asian countries.

Growing conditions
Rice can grow in any agro-ecosystem under upland conditions so long as there is enough moisture to sustain the crop throughout the growth period. As noted, some of the varieties can be grown in low and wet fields. However, water logged soils are inappropriate.

Land preparation
For newly cleared areas, stumps of big trees should be removed before the rains, preferably from November to February. All stumps should be moved before ploughing. Thereafter, land should be ploughed twice and where possible disc harrowed twice with the first rains (from late Feb to early March). Without harrowing, a hand hoe may be used.

Recommended upland rice varieties

Variety	Maturity period (days)	Attributes
NERICA 1	105 - 115	Black to purple grain tip, resistant to blast
NERICA 4 (SUPERICA 2 or Bukenya)	110-120	Resistant to blast, good milling ability, performs on poor soils.
NERICA 10	110- 120	Has long awns, resistant to blast
Sindano	150	Are renowned for their aroma but have a long maturity period of about six months
SUPA	150	SUPA rice is preferred because of its special attributes particularly on its palatability, taste and aroma but have a long maturity period of about six months

Seed treatment
Before planting, bands should be constructed around and across the field to control water and improve water retention. 20 kg of wood ash should be added to 30 kg of rice seed. Ash reduces termites and damage by the African mole cricket after planting. One litre of water should be added to the ash mixture to prevent blowing away during drilling/planting.

Spacing and planting
The furrow opener method should be used for planting. Spacing between rows should be 30cm row to row and 5 cm between plants in the row.

Weeding

A hand hoe should be used for weeding two weeks after germination and 25 days after the first weeding. For chemical control, pre-emergence herbicides should be used like glyphosate after final harrowing and 2 days before planting. For pre/post emergence application, the use of a combination of buthaclor plus propanil or thiobencarb plus propanil is recommended. Two liters per acre will be needed. It should be applied 2 weeks after germination.

Pest control

Rats/vermin – Rats are very difficult to control in larger fields because of the abundance of food. Rats are very sensitive to their environment and will treat with caution any strange, foreign foodstuffs. Rat poison is not effective in the field due to a combination of reduced potency, rat resistance as well as weather/climatic conditions. Rat poisons commonly used in homes will not work in the field. Rat poisons to be applied in the field should be mixed with food and urine, since the smell of urine attracts rats.

Birds – Birds are very destructive to rice. Swarms of birds can cause heavy crop losses within a matter of days. Bird control is especially needed at 26 days after flowering of rice. It is recommended to place cow dung in a newspaper and put the wrapped cow dung in a kaveera. Holes should be punched at the top of the kaveera to allow smell to escape upwards and it should be hanged on a 2-meter pole. The other option is to use scarecrows or other bird scaring options.

Insects – Include the following:

Stem borers (Yellow stem borer, Striped stem borer, White stem borer) – Stem borers are generally considered to be the most damaging insect pest of rice.

Symptoms include longitudinal white patches on leaf sheaths, branches drying out without producing panicles. Panicles may simply dry out or fail to produce grain. Adult insects are nocturnal insects, which lay their eggs on the leaves or sheaths of rice plants. The larvae feed on sheaths before boring into the plant.

Control– Stem borers are difficult to control as once they bore inside the stem they are protected from chemical sprays. For the chemical control to be successful, repeated applications of the appropriate insecticide should be made to the foliage.

Leaf hoppers and Plant hoppers - The plant may have no symptoms of leaf hopper or plant hopper damage. However, feeding punctures can leave the plant susceptible to bacterial or fungal infections. Adult insects are pale green or brown-winged. Insects also transmit many rice viruses, which may cause the plant to dry out.

Control – Rotating the crop for one year is an effective and economical way of controlling hopper numbers. Also, planting resistant varieties is a very effective control method. Chemical control by an appropriate insecticide may be necessary, but should only be used if the insects have reached an economic threshold.

Diseases

The 3 major diseases of key economic importance that severely constrain rice production include the following:

Rice Blast – This is the most important disease of rice worldwide as it causes most damage in areas of intense cultivation. It is caused by a fungus. There are lesions on all parts of the shoot.

White to green or gray diamond-shaped lesions with dark-green borders. There is also death of leaf blades and rotting panicles.
Control – Resistant varieties should be planted (in areas where disease is not endemic). Over-fertilization with N should be avoided as this increases susceptibility to the disease. Systemic fungicides should be applied where possible.

Rice Yellow Mottle Virus (RYMV) – Normally infects the plant at the late stage. In severe cases, the plant may die. The virus causes a yellow or orange leaf discoloration, stunting, and sterility in rice. The factors that predispose rice to this disease are the presence of vectors (insects like the leaf/plant hoppers).

Bacterial Blight–It is also one of the most important diseases of rice. It causes yellow or white stripes on leaf blades; leaves appear grayish in colour; plants wilt and roll up. The growth of the plants appears stunted.
Control – Planting of resistant varieties and avoiding excessive N fertilization.

Cropping calendar

Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Land preparation												
Seed acquisition												
Planting												
Weed control												
Fertilizer application												
Pest and disease control												
Bird scaring												
Harvesting												

Reducing post-harvest losses

When to harvest
It is recommended to harvest when 90% of the grain has turned brown, and the straw on the panicle neck is yellow in comparison to the colour of leaves. Early or late harvesting should be avoided.

Threshing
The rice should be threshed immediately after cutting. To reduce discoloration, a drum or wooden surface should be used to keep off dirt or stones from mixing with the rice. The use tarpaulins is recommended.

Winnowing and Drying
This should be done immediately after cleaning the grains. The rice should be dried for 3 or 4 days at intervals of 4 hours per day on a clean surface or tarpaulin. The rice should be turned every hour to allow for uniform drying. The rice should not be left heaped. Rather, it should be spread to thin layers (up to 2-5cm) on tarpaulins.

Paddy Storage

Paddy should be stored in gunnysacks and placed on a raised floor to avoid moisture accumulation. Paddy must be stored in an environment of 13-14% moisture and must be protected from insects and rodents. ("Paddy" - refers to rice that is still in the husks i.e., before it is milled.)

Income/ Revenue Analysis

Activity/Input	**Traditional (Shs/acre)**	**Low input (Shs/acre)**	**High input (Shs/acre)**
Land clearing/burning	50,000	50,000	50,000
First ploughing (tractor)	70,000	70,000	70,000
Second ploughing (tractor)	70,000	70,000	70,000
Seed	10,000	48,000	48,000
Rope		3,000	3,000
TSP			22,500
Planting	20,000	35,000	40,000
Spraying			15,000
First weeding	40,000	40,000	
UREA			35,000
UREA application			10,000
Second weeding	40,000	40,000	
Bird scaring	40,000	40,000	40,000
Harvesting	27,500	50,000	70,000
Threshing/winnowing	10,000	30,000	42,000
Tarpaulins		8,000	8,000
Transporting home	7,500	10,500	12,000
Drying	9,000	12,000	14,000
Bags	13,500	20,500	24,000
Transporting to market/mills	35,000	52,000	72,000
Milling cost	78,000	130,000	170,000
Total Cost (Shs/acre)	**520,500**	**709,000**	**815,000**
Yield-Milled rice (Kg/acre)	**500**	**1,000**	**1,200**
UCOP (Shs/kg)	**1041**	**709**	**679**
Price at Miller (Shs/kg)	**1,500**	**1,500**	**1,500**
Gross Income (Shs)	**750,000**	**1,500,000**	**1,800,000**
Net Income (Shs)	**229,500**	**791,000**	**985,000**

6. Banana

Background
Uganda is the biggest producer and consumer of bananas per capita world-wide. It has an estimated production of 300kg per person per year, almost all consumed locally. Cooking Banana (matoke) is the staple food in large parts of the country, particularly in Central and Western parts of Uganda.

Soil and climatic requirements
Banana's prefer deep, fertile, free draining soils, which have capacity to retain adequate moisture. Optimal mean monthly temperature is 27^{o}C, with a well-distributed average annual rainfall at least above 800mm (1500 to 2500mm.)

Varieties
Cooking type – includes Mpologoma, Kisansa, Nakitembe, Kibuzi, Mbwazirume, Enyeru, Musakala, Nfuuka, etc.
Beer type – Kisubi, Kayinja
Roasted type – Gonja
Dessert banana – Ndizi (apple banana)

Areas of commercial production
Major areas of commercial banana production include Mbarara, Isingiro, Bushenyi, Ntungamo, Masaka, Rakai, and Bugishu.

Planting/ spacing
Planting should be done at the beginning of the rainy season. Clean planting materials should be used, tissue culture, or pared corm (all roots and the outer layer of the corm peeled off). Spacing tends to vary depending on the type of bananas. The tall types are widely spaced while the shorter ones are more closely spaced. On average, the spacing should be 10 feet (3.3m) by 10 feet (3.3m), which results in about 440 stools per acre.

Soils and application of fertilizer
Soil should be deep, well drained and loamy with high humus and optimal pH of 5.6-7.5. To realize high yields, nitrogen and potassium should be regularly added to the soil.
The crop will benefit from farm yard manure (FYM) if available. A dressing of 500g of single super phosphate (SSP), 500g of murate of potash (MOP) and 500g of calcium ammonium nitrate (CAN) at planting for each plant per season.

Weed control
Weed control is done mechanically by hand picking, hoeing, and/or mulching. The (hair) roots of banana plans are very close to the surface, which means that weed removal by hoe is not recommended.

Mulching
Mulching is preferred method for weed control, soil fertility improvement, and soil moisture conservation. As much mulch as possible should be applied. Mulching materials include banana leaves, grasses, etc. Mulch should be laid at a distance of 2 feet from the stool.

De-leafing
This involves removing old/dry leaves and other (superfluous) leaves. It is aimed at maintaining plantation hygiene and improving light penetration.

De-suckering
De-suckering seeks to maintain appropriate number of plants to reduce competition for light, water and soil nutrients. It is recommended to leave 3-4 main stems of varying ages per stool. Fewer number of stems result in bigger bunches.

Staking
Banana pseudo stems are likely to break under the weight of heavy bunches. It is therefore essential to use forked poles to keep the stems in an upright position.

Major pests
Banana weevil – It is the most destructive banana pest in Uganda and East Africa. Damage is most severe in neglected plots. The larvae burrow into pseudo stems thereby weakening them and making them easily damaged by wind.
Control -

- Selection of planting materials from uninfected stools
- Treating planting materials e.g., by dipping them in 'dieldrin solution'
- Chopping old stems longitudinally and using them to cover the soil
- Using pseudo stems to trap the weevils

Nematodes – They live inside roots and corms and cause death of roots. When damage is severe, the plant topples when blown by wind.
Control – Use of clean planting materials i.e., those developed by tissue culture or treated ones.

Major diseases
Panama disease–It is caused by a fungus (*Fusarium)*. Symptoms include yellowing of lower leaves, which later hang downwards as well as purple discoloration of vascular tissue inside the stems.
Control – Use of resistant varieties and clean planting materials

Banana bacterial wilt (BBW) – All banana varieties are susceptible to BBW. It can destroy up to 70-80% in many plantations and cause yield losses of 90%. It is spread through garden tools and infected planting materials.
Control -

- Use of clean planting materials
- Disinfection of tools with fire or JIK
- Cutting and burying infected plants
- Removal of male buds by use of a forked stick as soon as last clusters have formed.

Black Sigatoka – Also known as "black leaf streak". It causes severe losses of up to 50% of the plantation and immature ripening of the fruit.
Control – Use of resistant varieties and clean planting materials

Yield Expectations (per annum)

Technology	Bunch size	Bunches per acre	KG per acre
Traditional	8kg/bunch	900	7,200
Low Input use	20kg/bunch	700	14,000
High Input use	35+kg/bunch	700	24.500

Maturity and post-harvest handling

Average time to maturity is 12 – months, depending on cultivar. With larger plantations, harvesting is all year round although bumper harvests occur between July to August and February. If well managed, banana plantations can last for more than 30 years. Bananas for the local market require no special post-harvest handling.

Marketing

Bananas generally serve as food crops and cash crops. Traders usually buy the bunches from farms and transport them using bicycles or lorries to open markets. The price of a bunch is largely determined by its size and market forces.

Crop production calendar

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Land clearing and preparation												
Planting												
Digging trenches												
Weeding												
De-leafing												
De-suckering												
Mulching												
(In)organic fertilizer application												
Opening trenches												
Harvesting												

Income/Revenue Analysis
(Per acre per annum)

Activity	**Traditional**	**Low input**	**High input**
	Shs/acre	**Shs/acre**	**Shs/acre**
Pruning/de-suckering	18,000	25,000	25,000
Digging trenches		70,000	70,000
Weeding	55,000	55,000	
Herbicide application			58,000
Ash application	8,000		
Trapping weevils		27,000	
Mulching		350,000	700,000
Manuring		200,000	400,000
Weeding	55,000	55,000	15,000
Loosening soil	37,000	25,000	25,000
Pesticide application			32,000
Fertilizer application			160,000
Removal of stumps	75,000	75,000	75,000
Weeding	55,000	55,000	17,000
Pruning/De-suckering	15,000	25,000	25,000
Harvesting (Continuous)	110,000	160,000	160,000
Total Cost (Shs/acre)	**428,000**	**1,122,000**	**1,762,000**
Yield (Bunches/acre)	**900**	**700**	**700**
Yield (Kg/bunch)	**8**	**20**	**35**
Yield (Kg/acre)	**7,200**	**14,000**	**24,500**
UCOP (Shs/bunch)	**475**	**1,602**	**2,517**
UCOP (Shs/kg)	**59**	**80**	**72**
Farm gate price (Shs/bunch)	**3,000**	**6,000**	**10,000**
Gross income (Shs)	**2,700,000**	**4,200,000**	**7,000,000**
Net income (Shs)	**2,272,000**	**3,078,000**	**5,238,000**

7. Sunflower

Background
The potential socioeconomic importance of sunflower can be seen in light of its ability to satisfy Uganda's (and surrounding countries) edible oil needs and as a source of income for many farmers. Sunflower became a popular cash crop for farmers after the introduction of high yielding hybrid seeds by Mukwano in 2004, and the guaranteed market Mukwano offered. Presently there are two main buyers who own large factories for processing oil seeds in Lira: AK oils & fats (Mukwano) and Mount Meru Millers.

Climatic and soil requirements
Sunflower is best suited for a warm, slightly dry climate. Normal growth is between temperatures of 13^{o}C and 36^{o}C. Annual rainfall of 400 to 600mm is considered ideal.

Areas of production
Sunflower is produced in four major areas of Masindi, Teso, Lango and Bugishu.

Varieties/ planting/ spacing
The planting of sunflower is normally done in mid-March for the first season and in mid-July/August for the second (main) season. Examples of hybrid seeds that are doing well in Uganda are PAN 7033, PAN 7351 and PAN 7086. Planting of traditional Open Pollinated Varieties (OPV) is discouraged. The recommended seed rate for sunflower is 5kg/ha of hybrid seeds, which gives rise to a plant population of about 44,000 plants per hectare. A single seed is normally planted in holes that are spaced at 75cm x 25cm, at depth of 5cm.

Weed control
Early weeding should be applied 2 weeks after germination, then 2nd weeding 30-40 days after that. Effective weed control of sunflower is normally attained by use of the hand hoe and hand pulling. Chemical control should be used in large fields (>4 ha).

Fertilizer application
Sunflower utilizes large amounts of nutrients but it apparently does not respond significantly to artificial fertilizer application. This is attributed to the extensive root system that ensures the uptake of nutrients that naturally occur deeper in the soil.

Nitrogen – Necessary for proper growth and development
Phosphorus – necessary for proper root development

Basal fertilizer: 50kg per acre DAP, NPK. Then 4-6 weeks after germination 50kg UREA. Amounts are per acre.

The rates of absorbed nutrients are shown in the table below:

Nutrient	**Kg/ha**
Nitrogen	87
Phosphorus	35

Major pests

Birds – They present a serious danger to sunflower production as they can destroy large sections of the field in a very short term. They can be controlled through cultural practices like physical scaring and planting at the same time.

Major diseases

Sunflower has limited diseases that attack it, however, regular field visits and scouting is recommended. Remove affected plants and burn them. Still some diseases are worth mentioning.

Rust – This is a fungal disease that is characterized by dark brown little spots on the underside of the leaves and large spots on the upper side. Rust reduces yield, oil content, and seed size. It normally affects late-planted fields more than early-planted ones.

Alternaria leaf spot – It is one of the most prevalent and destructive diseases of sunflower which can reduce seed and oil yield by 27 to 80%. The symptoms first appear as dark-brown to black circular spots on the lower leaves.

Septoria leaf spot – This is a widespread fungal disease that normally affects 5-10% of the plants. It is characterized by small irregular spots on the lower leaves, which gradually spread to upper leaves. The spots usually start on the margins of the leaves and coalesce to form yellow to dark-brown blotches.

Verticillium wilt – It is caused by a persistent soil borne and seed borne fungus that can remain in the soil for several years. It can thus be a problem on light soils where sunflower has been grown many times. Disease symptoms generally first appear on older plants as prominent, yellow, patches between leaf veins. Later, they coalesce to form brown, necrotic areas. The affected leaves rapidly dry and die. Affected stems have black, streaky patches on them. The plants start to show stunting, black flower heads and root destruction.

Control measures

- Planting of resistant varieties
- Crop rotation with 4 years between successive sunflower crops
- Treatment of seeds

Harvesting

Harvesting is done 100-115 days after planting depending on weather conditions. It is usually done by hand through hand cutting with knives, then dried in the field before threshing and winnowing. Then seeds are dried for 3-4 days before bagging and transporting to the market.

Yield expectations

	Yield (Kg/ha)	**Yield (Kg/ac)**
Traditional	900	350
Low input	1500	600
High input	2400	1000

Processing out turn

Milling out turn is about 30% oil, 45% to 55% seed cake, and 15% to 25% husks plus other matter. The seed cake can be further extracted by using solvent extraction method. This will yield additional 12% sunflower oil.

Crop production calendar

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Land preparation												
Seed procurement												
Planting												
Weeding												
Fertilizer application												
Pest and disease control												
Bird scaring												
Harvesting												

Income/Revenue Analysis

Activity	Traditional (Shs/acre)	Low input (Shs/acre)	High input (Shs/acre)
Land clearance	20,000	20,000	20,000
First ploughing	70,000	70,000	70,000
Second ploughing	70,000	70,000	70,000
Seed	2,500	18,000	18,000
DAP			30,000
Urea			30,000
Rope		3,000	3,000
Planting	10,000	15,000	15,000
First weeding	18,000	25,000	25,000
Second weeding	18,000	25,000	25,000
Bird scaring	20,000	25,000	25,000
Harvesting	10,000	14,000	20,000
Mats/Tarpaulins	4,000	8,000	15,000
Threshing	9,000	13,000	18,000
Transporting home	6,000	11,000	20,000
Drying	3,500	7,000	10,000
Winnowing	4,500	8,500	12,500
Bags	5,000	10,000	20,000
Marketing/transporting to buying center	4,000	10,000	20,000
Total Cost (Shs)	**274,500**	**352,500**	**466,500**
Yield (Kg/acre)	**350**	**600**	**1000**
UCOP (Shs/Kg)	**784**	**587**	**466**
Farm Gate Price (Shs/Kg)	**700**	**800**	**800**
Gross Income (Shs)	**245,000**	**480,000**	**800,000**
Net Income (Shs)	**-29,500**	**127,500**	**333,500**

8. Dairy production

Background
Diary production plays a major role in Uganda's economy. Milk is an important source of food, particularly fat and protein is needed for maintaining proper nutritional health especially in infants. Diary production also provides an important source of employment for various people involved along the diary value chain. The demand for dairy products has been increasing with the increasing population; milk production continues to be low particularly in Eastern and North-eastern Uganda where milk infrastructure remains less developed.

Major areas of production
In Uganda, dairy farming is common in the 'cattle corridor', which stretches from the South-western and Western regions through the Central and parts of the Eastern region to the North-eastern region. The cattle corridor is basically an area of high cattle-keeping concentration. It is estimated that about 60% of the households in the cattle corridor are livestock farmers.

Dairy cattle breeds
The key breeds of dairy cattle include the following:

Friesian
- These are the best-known dairy cattle.
- They are large, black & white in colour, with a very large udder and high milk yield.
- The weight of a mature Friesian cow ranges between 500-600kg
- Friesians are commonly used for improving other (low-yielding) breeds through crossbreeding.

Jersey
- It is the smallest breed that is commercially milked. It is a light animal that is suitable for tropics because of its ability to tolerate heat
- Jerseys are generally brown, ranging from copper to dark brown with dark eyes
- Although small in stature, their milk is high in butter fat (5%-6%)
- A mature Jersey will weigh about 350 – 450kg

Sahiwal
- The Sahiwal has a small head with a long, narrow face and short horns that grow and curve inwards.
- They have a well developed udder with prominent teats and a large hump
- Originates from South Asia and is an excellent breed for tropics
- The legs are short and sturdy with well-shaped hoofs
- The average weight of a mature Sahiwal cow is about 400 – 420kg
- Like the Friesian, the Sahiwals are commonly used for improving local breeds.

East African Zebu
- Sometimes referred to as the "humped" cow because of its very prominent fatty hump.
- They have humps on their shoulders, large dewlaps and droopy ears.
- Well adapted to withstanding very high temperatures and disease pressure, common in tropical countries.
- The average weight of a mature zebu bull is 350 – 420 kg

- They are very versatile as they can be used as draught animals, dairy cattle as well as beef cattle. However, production is low.

Ankole cattle

- Also known as long-horned cattle, they have high survival abilities as they can utilize poor forage and limited quantities of water.
- They are generally medium-sized cattle with a mature cow weighing 280 – 400kg and bulls weighing 540 – 730kg.
- Milk production is low (1.5-4 litres per day) but with high butter content (5%-7%) They produce lean beef.

Cattle rearing systems in Uganda

Cattle rearing systems in Uganda include herding, fenced, tethered and zero grazing systems. Herding is the most extensive, traditional system and it features virtually no use of external inputs. In fenced systems, cattle are kept on a designated piece of land with low use of external inputs. The more intensified zero grazing system involves keeping cattle in stalls and feeding on specialized fodder and supplements like salt licks and concentrates to boost milk production.

Dairy cattle management

Birth

- In the period between 40 days before calving and 60 days after calving the cow is most vulnerable. It should be well cared for in order for it to enjoy a smooth birth and good lactation period.
- To prevent stress, the cow must be separated from other cows during calving. Measures should be taken to ensure a hygienic calving process.
- Ninety per cent of all calving takes place without any help from the farmer. Help is required only with very heavy cows or where the calf's posterior comes out first.

Calf nutrition

New born calves should be fed on colostrum (first milk from a cow) as soon after birth as soon as possible and as much as possible. This is to gain immunity against diseases. Later on, milk should be fed to the calf at least twice daily (more is better), by letting it suckle from its mother or by bucket feeding.

Heifer nutrition

In a diary enterprise, greater interest is put on female calves. The farmer has the option of selling them off immediately or raising them until they are bigger and then sell them or use them as replacement stock. The following feeding program should be followed:

12weeks – 1 year

During this period, feed the calf on all available types of excellent forage and limited concentrates. Good feeding and care results in good milking animal. The calves must have access to clean water at all times.

1-2 years (up to 2months before calving)

If good quality forage is available, it may be the only feed required to feed heifers that are over one year of age. Add to this a salt lick block that contains different minerals like phosphorus.

Note that heifers deficient in energy, phosphorus or vitamin A will not exhibit oestrus. Heifers will normally show their first oestrus just before 12 months of age.

Types of feeds

Forage – includes grasses and fodder legumes
Concentrates – include wheat/maize bran, soya meal, maize flour and pre-mixes. For high lactating animals. Use 1 kg for 2 litres of extra milk above 10 litres.
Other by-products – cotton seedcake, fishmeal, molasses, and poultry waste. They are usually by-products of other industrial or farm enterprises but are rich in nutrients.
Feed additives – include minerals and vitamins, livestock salts.

Feeding a lactating cow

Nutrient requirements vary with the stage of lactation. Milk production increases rapidly during the early lactation phase (0-70days after calving) peaking at 6-8 weeks after calving. Intake of good grasses, legumes and concentrates should thus be increased during this period. The mid and late lactation phase is 140-305 days after calving. During the phase, milk production is declining because the cow is in-calf. This is followed by the dry period (when milk stops), which commences at 60 days before calving. Adequate minerals and vitamins should be provided at this stage.

External parasites affecting cattle

Ticks – cause blood loss, discomfort and transmit diseases like anaplasmosis. They are found primarily on legs, lower abdomen and ears of animals. They are very difficult to control in areas with high tick populations.
Control – spraying, dipping, pour-ons, etc.

Horn flies – they are about the size of a housefly and they are dark grey in colour. They suck blood and stay on the back and shoulders of the animal almost continuously.
Control – high pressure sprays, pour-ons, insecticide-impregnated ear tags, etc.

Mites/Mange – Infestation causes loss of hair and skin thickening. Severe infestation weakens the animal and makes it vulnerable to diseases.
Control – they are usually controlled with pour-ons

Internal parasites affecting cattle

They include roundworms, lungworms and liver flukes. These hidden parasites cause poor performance and can kill young animals. Cattle normally pick internal parasites while grazing. They invade the digestive systems and cause indigestion and damage to internal organs.
Control – Regular de-worming of animals using recommended antihelmintic drugs like Albendazole, etc.

Dairy cattle diseases

East Coast Fever (ECF) – One of the most important diseases of cattle in Uganda which is transmitted by infected ticks. Signs include fever, swollen lymph nodes, soft cough due to accumulation of fluids in lungs, diarrhoea tinged with blood, and white discoloration of eyes. If not treated, the animal will collapse and die within 4 weeks of infective tick bite.
Treatment – achieved by injecting with purvaquone, buparvaquone or other effective antibiotic.

Anaplasmosis – Occurs primarily in warm tropical climate areas. Transmitted most commonly by ticks but also unsterilized sharp objects like needles, castrating instruments, etc. It causes anemia, fever, weight loss, breathlessness, uncoordinated movements and death.
Treatment – consists of the administration of tetracycline. A vaccine is also available for this disease.

Foot and Mouth Disease (FMD) – a severe, highly contagious viral disease with significant economic impact. Intensively reared animals and young animals are more severely affected. Its characterized by fever and blister-like sores on tongues and lips, teats, and between hoofs. It causes severe production losses and recovered animals are debilitated.

Mastitis – Infection of mammary glands caused by bacteria. Acute stage shows a swollen and painful udder with loss of appetite. Bad hygiene and poor milking methods (stripping) are the primary cause.
Treatment – Clinical mastitis is treated by intra-mammary infusion of antibiotic after milking out the cow.

Foot rot – Caused by a crack in the feet especially between the hoofs, where bacteria can enter. The foot swells and emits a characteristic foul smell. The animal becomes lame and the infection may kill the animal if it spreads.
Treatment – Farmer should use a footbath with copper sulphate (2%). Th animal should be treated with antibiotics like tetracycline, penicillin.

Income/Revenue Analysis

Detailed Activities	**Traditional Free range**	**Low input Fenced**	**High input Zero grazing**
Project Expenses	**1 cow**	**1 cow**	**1 cow**
Dairy meal (5kg/day–300days@s800)	-	-	1,200,000
Mineral block/salt	20,000	35,000	70,000
Maize bran	-	80,000	-
Deworming	30.000	60,000	60,000
Multi-vitamin injectable	-	-	20,000
Acaricides (Decatix)	45.000	60,000	90,000
Ropes	30,000	30,000	-
Labour	-	200,000	400,000
Fodder	-	100,000	400,000
Vet services & drugs	-	60,000	90,000
Total	**125,000**	**625,000**	**2,330,000**
Project income			
Average litres of milk/day	2	8	20
Average litres of milk/month produced	60	240	600
Average litres of milk/month sold	45	210	540
Total litres of milk sold (10 months)	450	2,100	5,400
Farm gate price/litre of milk	650	650	650
Gross income	**292,500**	**1,365,000**	**3,510,000**
Net income	**167,500**	**740,000**	**1,180,000**

10. Beef production

Background

Livestock production in Uganda contributes significantly to the total GDP and the agricultural GDP. It is an integral part of the agricultural system in many parts of the country. Smallholder farmers own over 90% of the cattle herd, cattle being the most important type of livestock kept in Uganda. Livestock production has continued to grow appreciably in response to the increasing demand for milk and meat products in the local market. Cattle can make efficient use of feed resources that have little alternative use such as crop residues and land that cannot produce crops other than grass.

Beef-rearing systems in Uganda

Traditional beef production: Practiced by pastoral tribes in the drier areas. It is characterized by communal grazing, periodic migration, and overgrazing near watering points. Herds consist of small but well adapted low producing animals.

Commercial beef production: Carried out in low and medium agro-ecological zones known in extensive areas known as ranches. Ranches are fenced and provided with adequate water. Major beef breeds are the Boran or cross breeds. Sometimes, immature stock can be bought and fattened is short period of time using high energy supplementary feeds.

General characteristics of beef cattle

- Stocky square body
- Almost straight top and lower lines
- Deep body with short legs
- Fast growth and early maturity

Cattle breeds

1. Small Short Zebus

- Small sized animals
- Hardy, gentle, intelligent and relatively easy to raise
- Low growth vigour
- Tolerant to heat
- Have very good resistance against internal and external parasites
- Mature cows can weigh up to 250 – 350kg

2. Boran

- One of the most important indigenous beef breeds
- Medium sized animal
- Loose dewlap and large hump
- Compact body, good depth and width
- Fairly large animal with fairly long legs
- Mature cows can weigh up to 350 – 480kg
- Mature bulls weigh 500 – 850kg
- Used as pure breed and for improving local breeds
- Calves very well

Beef cattle management

Beef rearing enterprises normally use systems whereby calves or weaners are raised or purchased and are then fed/fattened to make them ready for slaughter. The farmer's objectives are mainly three i.e., production of young animals, fattening of the animals and selling them off. This means that the farmer should have a breeding herd that consists mainly of cows and some few bulls. All management activities should therefore aimed at maintaining the breeding cycle so that there is a constant supply of animals for fattening.
Another strategy is to buy animals when they are lean and cheap, that is at the end of the dry season. Then fatten them and sell them at times when prices are high, that is before Christmas or Easter holidays.

Managing calves
In the last 80 days before the cow gives birth, it should be fed well with the best pasture in order to increase the vigour of the unborn calf and prepare the cow for lactation. Following birth, the calves should be kept in an area that allows the farmer to observe them closely for about 2 weeks. This allows the farmer to assess their behaviour and identify disease early enough to prevent its spread and damage. The early operations of dehorning, castration and vaccination should be done during the first 3 months after birth. The calves are grown on milk and weaned off at 6 – 10 months. After two months, the calves can still be fed on some milk but get more exposed to grass. Some farmers simply feed out and sell off these weaned calves, in which case the investment on each calf is returned in a comparatively short time.

Managing breeding stock
When the animals are 18 months old, the beef farmer should divide them into two herds i.e., animals for breeding and animals for fattening. Breeders include heifers and bulls while animals for fattening include steers, heifers and bulls. Because the future of the program depends on the fitness of breeding animals, it's important to maintain good health by not allowing the animals to get too fat or too thin. Cattle have a gestation period of 283 days. The rule of thumb is to have a single bull serving 25 cows. Some farmers do not maintain any bulls and they depend on leasing a bull from a neighbouring farmer for use during the breeding season. Another good breeding option is artificial insemination (AI) which is often done with the aid of a veterinarian.

Managing beef fattening stock
Feeding of beef cattle is the most important aspect of beef cattle management as it determines the time taken to reach maturity, the market weight and the price. Poor quality of grass and its limited availability during the dry season tends to arrest growth. Grass management is thus of vital importance.
Animals should be fed daily with 1-2kg of supplements like brewers waste per day. In addition to the supplements, roughage (grass) should be provided at 3% of body weight. The animals should also be provided with clean water ad libitum. Ordinary rock salt should be provided at 30-40 grams per animal per day. All feeds should be mixed properly with at least 15-20% roughage in the feeds to prevent bloating and other digestive disorders. Supplementary feeding using straws, silage, urea, molasses and mineral licks should be adopted especially during drought.
Most animals in Uganda are fattened on pasture grasslands rather than feedlots. The animals are fed on naturally occurring grass without necessarily planting any recommended grass or

legume species. This often results in slower growth rates and longer maturity periods. Care should therefore be taken to avoid over-stocking, as this will limit the amount of grass available to each animal. Rotational grazing – whereby the grazing area is divided into paddocks and animals rotated from one paddock to another - should be adopted in order to allow for rapid recovery of grass.
Fatteners are sold off when they are generally bigger and mature or nearing maturing. In general, animals should be fattened for six months and sold off when they are 250 – 350kg.

Income/Revenue Analysis

Detailed Activities	**Traditional (10 animals, 18 months)**	**Low input (10 animals, 18 months)**	**High input (10 animals, 6 months)**
Project Expenses			
Calves	1,000,000	1,800,000	1,800,000
Brewer's mash (@ 50,000 pick-up)	-	-	600,000
Mineral block/salt	30,000	60,000	60,000
Maize bran (@ 60,000 / 100kg bag)	-	1,200,000	720,000
Deworming (Albas 10%&Levamisole)	-	144,000	96,000
Multi-vitamin (injectable)	-	-	108,000
Anti-trypanasome drug (Diminazine)	-	60,000	60,000
Acaricides (Decatix)	180,000	180,000	120,000
Ropes	-	30,000	30,000
Labour	240,000	720,000	720,000
Vet services	40,000	60,000	120,000
Treatment – ECF, etc.	50,000	100,000	100,000
Identification numbers & labour	-	70,000	70,000
Sub Total	**1,540,000**	**4,424,000**	**4,604,000**
Gross income			
No. of own cows fattened	10	10	10
Price per cow at time of sale	300,000	650,000	900,000
Gross income	**3,000,000**	**6,500,000**	**9,000,000**
Net income	**1,460,000**	**2,076,000**	**4,369,000**

11. Poultry production - layers

Background

Egg production in Uganda has become popular during the last 10 years. This has been due to the good business opportunities and development of input industries like commercial feeds, poultry drugs and vaccines, and availability of good breeds (day old chicks). However, the cost of feeds (and other inputs) has become very high and the prices of eggs lagged behind. This resulted in larger scale production methods to reduce the cost of production.

Key requirements for a successful egg production poultry project

- *Land* – adequate land needed for construction of poultry structures plus conducting other operations
- *Water* – clean water needed for consumption and cleaning
- *Capital* – needed for purchase of inputs and running the project
- *Skills & experience* – needed for running the project

Main Layer Breeds in Uganda

In Uganda there is a preference for brown eggs. Those eggs are produced by:

- Hisex Brown
- Lohmann Brown
- Bovans Brown

Poultry rearing systems

Free-range system – The free-range system of poultry keeping can be divided into two i.e., traditional free-range and improved free-range systems.

- *Traditional free-range* – it is the most common system used in villages. It is basically a low-productivity system used for keeping poultry on a subsistence scale. The birds are left with little or no care and they have to scavenge for food, which is normally kitchen refuse, worms, maggots, etc. Young chicks often scavenge with adults, having to compete for feeds and becoming easy prey for predators and spread of diseases. The system is based on hens that have the ability to brood and rear chicks, although the periods of brooding are long, which results in reduced egg production.
- *Improved free-range* – it is an improved form of the traditional free-range system. The chickens are provided simple housing and they are reared for both subsistence and commercial purposes. The birds are also provided with a good supply of varied feeds and clean water in addition to being kept in an enclosure like a perimeter fence. Usually, 200 – 300 birds are kept per unit. Disease prevalence may be relatively high but lower than for the traditional free-range system described above, provided vaccinations are applied.

Deep litter system – in this system, the hens are confined in housing with floor space of 8-10 birds per square meter to allow for free movement. The floor should be covered with 5-10cm of deep litter of coffee husks, straw, wood shavings or a similarly adsorbent material. Old litter is renewed when replacement stock is brought in. The advantages of the deep litter system include low capital investment and relatively higher rates of stocking. But the incidents of such vices like cannibalism is high (de-beaking can be considered) and rate of disease spread can also occur if the litter is left to be damp.

Battery system – also known as the laying cage system. In this highly intensive system, the hens are kept in cages throughout their productive life. The cages are maintained in levels with one cage being placed on top of another. This results in high stocking rates, easier monitoring of egg-laying performance, absence of vices and low disease spread. However, capital investments are very high.

Management of layers

Growth stages:

- Young chicks: Bird that is less than 9 weeks old
- Grower/pullet: Chick that is between 9 and 20 weeks of age.
- Layer: Bird that is at least 20 weeks of age and start laying eggs.

Housing:

- The house should be built up to a reasonable height with large enough windows to allow for proper aeration. Wire mesh should be used in to windows to restrict the birds and prevent intruders.
- An open-sided house is generally recommended for the health of the birds
- Where the deep litter system is used, the litter should be removed and replaced whenever new (replacement) stock is brought in. Litter should be kept dry at all times!

Housing space:

- Depends on age and weight of birds – see below table (500 birds):

	Chicks	**Growers**	**Layers**
Age (weeks)	0 - 4	5 – 20	21 – 78
Number of birds per m^2	10 birds	8 birds	5 birds
Floor space for 500 birds (m^2)	45.2m^2	55.4m^2	83.1m^2

Feeding of layers:

Type of Feed	**Utilization/values**
Chick starter mash	- Given to chicks up to 8 weeks of age - Carbohydrate and protein content is high to ensure high growth rate - Main constituents are calcium and protein necessary for metabolism - Amino acids and vitamins also included
Grower's mash	- Given to growers between 9-20 weeks of age - Carbohydrate and protein content is lower than that found in chick starter mash - Calcium and phosphorus levels are at fairly same levels with those of chick starter mash - Amino acids and vitamins included
Layer's mash	- Given to birds when they start to lay i.e., at 20 weeks - Carbohydrates and proteins are lower than for the

	above feed types - Rich in calcium levels for good egg shell formation - Vitamins and minerals included

Diseases and diseases control:
New castle disease – it is a fast spreading viral disease that affects poultry of all ages. Symptoms include coughing, difficult breathing, diarrhoea, lack of balance or inability of a bird to stand on its feet, twisted neck, severe drop in egg production and sudden death.
Control - incudes vaccination of chicks in 2nd week after birth followed by repeat vaccinations at 4 weeks and 14 weeks.

Coccidiosis– usually occurs at 8 – 10 weeks of age and may express itself in acute and chronic forms of diarrhoea. In the acute type, death may occur quickly. The chronic form lasts for long. Infected birds or chicks become inactive, usually have ruffled feathers and pale beaks. There may be blood in the droppings. Mortality may be high and sudden.
Control - includes use of sulphur drugs, use of coccidiostat in feeds, and ensuring dry litter.

Fowl typhoid – caused by Salmonella usually in the gut of chicks. Symptoms include dullness, ruffled feathers, loss of appetite and orange coloured diarrhoea. It is introduced to a flock by infected birds, materials, shoes, and litter.
Control - includes vaccination of birds at 7 weeks of age, burning dead birds and barring visitors from entering poultry house without disinfecting their feet.

Endo-parasites – these include roundworms, tapeworms, and gapeworms.
Control – Birds mainly pick up worms when kept outside under free-range system. De-worming drugs should then be applied.

Vices – birds can develop abnormal vices like cannibalism, breakage and eating of eggs, etc.
Control - Birds should be de-beaked to stop them from pecking their own eggs.

Infectious Bursal Disease (Gumboro) – viral disease affecting young chickens. Symptoms include sudden onset, depression, ruffled feathers, droopy appearance, and pecking at the vent. Birds usually die of dehydration.
Control - is by vaccination at 2 and 4 weeks of age.

Layers Production Cycle:
Laying pullets should, on arrival, be given layer's mash. After 18 weeks, only a few hens will lay eggs. However, from the 21st week, 80% of the flock will start laying eggs. A hen should lay between 310 and 320 eggs over a period of 15 months.

Income/Revenue Analysis

Detailed Activities	**Traditional 50 birds**	**Improved 200 birds**	**Intensive 1000 birds**
Expenses (Day-old – end of laying stage)			
Cost of chicks	50,000	550,000	2,750,000
Labour	-	150,000	900,000
Coffee husks (bags)	-	-	130,000
Local feeds (kitchen refuse, maize bran, maize, beans, etc.)	500,000	7,000,000	-
Brooding (electricity, fuel, etc.)	-	-	450,000
Feeds-chick & growers mash (<20 w)	-	-	9,700,000
Feeds-layer's mash (20-80 weeks)	-	-	55,550,000
Drugs, vaccination, vet services, etc.	50,000	150,000	400,000
Transport to market	-	500,000	3,000,000
Total expenses	**600,000**	**8,350,000**	**72,880,000**
No of egg-laying birds	30	150	900
Total No. Eggs/bird	60	240	315
Total No. Eggs/ flock	1,800	36,000	283,500
Farm gate price/egg	500	280	280
Income from egg sales	900,000	10,080,000	79,380,000
Farm gate price/off-layer bird	10,000	5,000	5,000
Income from off-layer bird sales	300,000	750,000	4,500,000
Gross income	**1,200,000**	**10,830,000**	**83,880,000**
Net income	**600,000**	**2,480,000**	**11,000,00**

12. Poultry production - broilers

Introduction

The poultry industry in Uganda plays an important role in rural socioeconomic development and the improvement of standards of living through job creation and poverty alleviation. The rising demand and high prices of poultry has inspired many people to venture into the industry. Although commercial broiler production was in an infant stage about 8 years ago, the opening up markets in South Sudan and DR Congo increased the demand for poultry meat, which drove broiler production upwards.

Key requirements for a successful broiler production poultry project

- *Land* – adequate land needed for construction of poultry structures plus conducting other operations
- *Water* – clean water needed for consumption and cleaning
- *Capital* – needed for purchase of inputs and running the project
- *Skills & experience* – needed for running the project
- *Feeds* – Broilers consume substantial amounts of poultry feeds

Main broiler breeds

Cobb, Hubbard, Lohmann are examples of companies that produce broiler breeds, white birds with yellow legs and beak. Have the ability to grow fast and use relatively little feed. Birds can grow up to 4 kg live weight. Day old chicks can be bought from several sources in Uganda (e.g. Ugachick).

Planning and preparation for chicks

The following activities should be carried out prior to the arrival of day-old chicks:

- Cleaning and disinfection of poultry housing
- Litter materials (coffee husks, rice husk, wood shavings) should be evenly spread out at depth of 8-10cm
- Pre-heating of poultry housing up to a temperature of 34^{o}C for a minimum of 4 hours before arrival of chicks
- It should be ensured that adequate clean water (vital for chick development) is available
- It should be ensured that there is enough gas/charcoal for heating
- Drinkers and feeders should be placed around the heat source

Feeding

Chicken feed constitutes the largest cost in the production of broilers. About 60–70% of all costs in the broiler production process are attributed to chicken feed. Care must therefore be taken to avoid wastage. Chicks should be fed with a starter diet soon after they hatch. This should be continued until they reach 3 weeks of age. When the chicks complete 3 weeks of age, the farmer should start feeding them on broiler finisher until they reach slaughter size. In summary:

- 1day–3 weeks: 1.0kg of broiler starter (under good management)
- 4–7 weeks: 3.0kg of broiler finisher (under good management)

The live weight of a bird at 42 days will be around 2 kg. Feed conversion should be below 2.0 preferably 1.75 under good management.

Housing space

- Each broiler should be on 1 square ft. (30x30 cm) when reaching selling weight. This means that 10 ft. by 10 ft. (3.3m x 3.3m) can accommodate 100 birds. Using the metric system, 1 square meter can accommodate up to 11-13 broilers.

Disease control

[*For details of poultry diseases and their treatment, refer to the egg production manual*]

- Floor should be covered with about 8-10cm of litter.
- The litter should always be kept dry. Dump or moist litter provides a good environment for infectious agents.
- The housing should be very well ventilated. In addition to providing oxygen, this also keeps the litter dry and aerated. Make sure your roof is not leaking!
- Broilers should be vaccinated against New Castle Disease and Gumboro.
- Visitors should be kept off from entering the poultry house, if their feet are not disinfected. Strict hygiene practices are very important to prevent diseases.

Vaccination programme

Age (Weeks)	Vaccine type	Administration
1st day in hatchery	Marek disease	
Day 5	Newcastle disease	Eye drop or in drinking water
Day 15	Gumboro	Eye drop or in drinking water
Day 28	Newcastle disease	In drinking water

The broiler production cycle

After procuring the day-old chicks, they are raised for 6 weeks during which they achieve an average live weight of around 2kg. At this point, they can be selected and sold off. The average maximum weight of 2.4kg is normally achieved at 7-8 weeks. A complete cycle is there 8 weeks long, which means that there can be as many as 6 cycles annually.

Records management

It is of crucial importance that the farmer should have for each poultry house a record book on which information on a number live birds in the house, feed consumption, vaccination dates, death and birds sold are recorded. Record keeping assists the farmer and loan officer to make appropriate calculations and make informed decisions about the project.

Income/Revenue Analysis

Activity	**Traditional 50 birds**	**Improved 200 birds**	**Intensive 1000 birds**
Project Expenses			
Cost of chicks	50,000	350,000	1,750,000
Labour	-	-	100,000
Coffee husks (bags)	-	80,000	160,000
Local feeds (kitchen refuse, etc.)	50,000	-	-
Brooding (fuel, etc.)	-	-	70,000
Feeds-broiler starter	-	310,000	1,700,000
Feeds-broiler finisher	-	722,000	3,900,000
Drugs, vaccination, vet services, etc.	30,000	50,000	100,000
Total expenses	**130,000**	**1,462,000**	**7,780,000**
Project Income			
Total No. Birds sold	30	170	940
UCOP	**4,333**	**8,600**	**8,277**
Farm gate price/bird sold	15,000	11,000	11,000
Gross income	**450,000**	**1,870,000**	**10,340,000**
Net income	**320,000**	**408,000**	**2,560,000**

13. Other value chain actors

This short chapter briefly touches upon the main technical and agronomic characteristics of processors and produce traders.

13.1 Processors/ millers

There is a large variety of millers and processors in Uganda, ranging from simple maize mills or coffee hullers to large dairy processors. Processing is an activity that adds value by changing the nature, texture, volume etc. of the product in question.

Processing as a service?
Processing can be done as a service, for instance, milling maize or hulling coffee per bag. It can also be done as a value added activity on a product that is in ownership of the company. For instance a dairy cooling unit purchases milk, cools it, stores it and sells it on to a factory. Needless to say, the loan officer should have a good understanding if the processor:

- Processes products as a service against a price per kg or per bag; goods stay in ownership of the processor's client;
- Processes products to benefit from the value added; the products that are processed are in ownership of the processor.
- A combination of the above.

Electricity (and water if relevant)
There should be uninterrupted power supply to make use of the processing capacity, either through reliable power supply or through generators or alternative sources of energy such as solar. Usually electricity (and/ or fuel for the generator) is the largest expense of a small milling or hulling machine.

Seasonality
More often than not, processors are dependent on the post-harvest season(s) for their business. Thus it is unlikely that processors will be processing year-round. It is important that the loan officer understands the seasonality of the business.

Technical expertise and expenses
The processor should have sufficient technical expertise to ensure the day-to-day business runs smoothly. Maintenance expenses should be budgeted

Local demand for services in relation to processing capacity (if processor offers service)
The processing capacity of the client should not greatly exceed demand as idle capacity may represent high overhead cost. Ideally the demand should exceed capacity or at a minimum be at 50% of capacity.

Availability of storage facilities for processed product (if processor processes own product)
Is the processed product stored before it is sold on? If so, is there sufficient storage facility? Storage should be clean, tidy. It should be waterproof, i.e. not leaking. Some products require cold storage, which in turn is dependent on electricity.

Packaging (if applicable)
Does the processed product need packaging and if so, is the packaging attractive and adequate? What is the cost of packaging?

Marketing
Here we need to understand how the product is being marketed. Are goods sold to wholesaler distributors against agreement at the processing plant? Does the processor have its own sales force that markets the product to retailers?

13.2 Produce traders

Traders and markets
Produce traders or middlemen purchase agricultural produce from farmers or other middlemen and sell it on to other middlemen, large organizations such a World Food Program, to exporters, or choose to export produce themselves.

Contractual arrangements and price risk
It is important to understand if the traders have agreements with farmers/ producers on price and/ or with a buyer of that produce. This will determine to what are exposed to price risk.

Traders of agricultural produce are vulnerable to price risk when they:

- Agree on a price for purchases from farmers or other traders, without having an agreement on the sale price of that produce with a buyer: they go 'long'.

  or
- Agree on a selling price with a buyer, without having an agreement on the purchase price of that produce with farmers or other traders: they go 'short'.

The greater the quantity, the greater the potential loss should the market price of the produce move against the trader's position. The size of a contract by itself does not cause risk, but it determines the financial impact (exposure) that the trader will face should a risk situation materialize.

The timing is also of influence, because the longer this price risk persists, the more opportunity there is for the market to move against the trader. Conversely, if the buying and selling are closely timed, the period of exposure is shorter.

It should also be determined if the trader is trading with speculative intent. If so, the care should be taken to finance such traders.

Experience
Given the significant price risk that traders are exposed to, it is important to determine the actual experience of the trader in trading in a certain crop. Inexperienced traders are more likely to lose money.

Prepayments and credit
Some produce traders may pre-pay farmers for standing crops. This is not uncommon for instance in coffee. Traders may sell on credit – especially to large organizations and/ or governments, thereby exposing themselves to liquidity risk.

Seasonality

There is likely to be significant seasonality in the volumes traded. As a consequence the profits are likely to be concentrated in a few months of the year. Seasonality can be compensated for if the trader deals in different parts of the country and/ or in multiple crops.

Availability of storage facilities

Is there sufficient storage facility? Storage should be clean, tidy. It should be waterproof, i.e. not leaking and sufficiently large.

Transport arrangements

Here we need to understand how the produce is transported from where it is bought to where it is sold. Does the trader have his own truck(s) or does he rely on others? Is there a formal arrangement in place?