Simplified Practical Hand Book for

GROWING OYSTER MUSHROOMS

AGENCY FOR INTERGRATED
RURAL DEVELOPMENT (AFIRD)

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Furthermore, we would also like to thank our development partners Misereor for providing the financial support to promote sustainable agriculture practices in Uganda and building our capacity to train farmers with limited resources.

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Finally we greatly appreciate the team spirit exhibited by AFIRD staff in putting this work on paper so that it can benefit many more vulnerable people in Uganda and beyond.

Lastly but not least, I wish to thank our trainees and pupils with whom we have implemented and collected information on mushrooms growing. It's my plea to all development agents; Government, Donors, NGOs, CBOs, Development groups, individuals and public at large never to give up but continue with the strangle against poverty.

PREFACE

Agency For Integrated Rural Development (AFIRD) was founded in 1997 by a group of professionals who realized the need for an integrated approach to rural development. They combined together to create synger to build agriculture development in Uganda. It registered in 1998 as an Non-Governmental Organization (NGO) in 1998 (Reg. No: S 5914/2404). Today it is a national NGO was a mandate to operate in all parts of Uganda.In the last two decade AFIRD has been engaged in promoting sustainable agriculture practices amongst the small scale farmers.

AFIRD has a vision of a society free from hunger and disease living in a peaceful and greed environment. Its mission is to enable the more vulnerable smallholder farmers in the increase urbanizing district in central Uganda to be more food secure and to have increased income with special emphasis on the youth. Five program areas have been developed; (1) Agriculture production and environment, (2) Youth Empowerment, (3) Agricultural Market Development, and (4) Advocacy and lobbying.

One of our strategic objectives is increased sustainable and well documented animal and crop diversity and production practices for improved income for target farmers.

Over time the organizations has recruited well qualified personnel, setup a demonstration unit for confined farming technologies and acquired transport.

For the last two decades AFIRD has been on ground interacting with farmers through mobilizing and sensitizing farmers, organizing and conducting trainings on SA farming techniques, encouraging farmers to add value on their produce, providing extension services especially for farmers with limited land resources. Mushroom production has been realized as one of suitable enterprise for farmers in the target area.

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LIST OF PHOTOS

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Simplified Practical Hand Book for Growing Profitably Oyster Mushrooms in Uganda

INTRODUCTION

Producing mushroom is one of the farming businesses that can be started any time. It requires very little capital, very small space and is simple to do. Any person can therefore start growing oyster mushrooms for profit with limited resources. This booklet will give you hints and suggestions on factors to consider before undertaking mushroom production.

WHY FARMERS GROW MUSHROOM

The many benefits that can come out of mushroom growing include the following:

1. A direct and steady supply of highly nutritious food;
2. A steady income without leaving home;
3. Wasted, under-utilized and confined spaces in the home can be used profitably;
4. Big money can be made by farmers in very short time;
5. Many medical benefits can be got by people by eating mushrooms and
6. Wholesome truly organic food

BASIC REQUIREMENTs FOR GROWING MUSHROOMS

Growing mushrooms is a simple and straight exercise that requires just a few inputs and a controlled environment.

The most important are listed below:

1. Mushroom Houses-

well aerated, with dimmed lights, Cool, humid space free from draught air flows. The conditions can easily be achieved in a simple structure with wall made using locally available building structures. Depending on condition and area these include adobe bricks, mud and wattle, papyrus reeds and mats, timber off cuts, hard paper and grass. The structure can be roofed using similar materials but a leak proof material that does not trap heat must be included. Tarpaulin and or Polythene can be added as they are cheap, durable and are always available in local hardware shops. Trees shades and or climbing plants can also be allowed to grow around the structures to stabilize humidity and temperatures.

Mushrooms grow and fruit better in a micro-environment with high humidity, free air flow, low light and wide range of temperature. The species cultivated in the tropics have been selected to tolerate temperature ranging from 15 to 30 degrees Celsius. This enable farmers to produce mushroom easily using very simple structures.

Picture 1

Picture 2

Picture 3

Picture 4

Picture 5

Picture 1-5: Example of simple housing structures uses by Farmers

2. Darkroom

Mushrooms spores germinate and start grow into spawn in the dark. Spawn therefore also grow and colonize substrate better in total darkness. But mushroom formation or fruiting requires some light. The need for a dark room can be reduced to certain extent by working with black polythene bags or materials.

3. Supply of good inputs

These include good spawn, substrate, supplements, stabilizers and water.

1) Good spawn

Mushroom spawn or seed are normally produced under controlled conditions in laboratories and marketed commercially.But it can be produced by farmers that are growing large quantities of mushrooms. The spawn is normally prepared on order and packed in bottles or polythene bags and sold to mushroom growers on demand.

Picture 1

Picture 6: Spawn being prepared in bottle in the lab.

Young mushroom growers can easily identify a supplier by consulting fellow farmers. The spawn is often sold as ready to plant in air tight bottles or polythene packs with instructions on how it should be used. But roughly, 150g of good spawn is enough to plant 5kg of substrate.

2) Substrates

Spawn can grow on almost all types of dead plant materials.
The common one in Uganda include:
1. crop residues like; Maize stovers, Maize cobs, Sorghum stovers, Rice straws, Millet straws, Wheat and Barley straws, Bean trash, Soyabean trash, Ground Nut shells,
2. Agroindustry processing byproducts like; Cotton seed huals, Wood shavings, Baggase, Sunflower seed husks and
3. Dry glass Hay like materials and
4. Biogas slurry.

NB. Cotton seed hauls give very good results and are easy to handle. Other materials must be chopped to enable parking and inoculating the spawn.

3) Supplements

The nutrient content in the substrate is normal low and often there need to provide extra nutrient. The common supplements include Maize bran, Wheat bran, Wheat porade, Rice bran and Biogas slurry waste.

4) Stabilizers

Mushrooms grow better on substrate with a neutral PH. But the natural substrates tend to be Acid. Commercial lime is therefore often added to raise the PH to around 7.

5) Water

Water used in the mushroom production must meet domestic standards. It should be obtained from a clean and safe point. This can be from underground springs, tap water or collected from the roof.

ESSENTIAL STEPS IN MUSHROOOM PRODUCTION

To produce mushroom efficiently the following steps must be carefully followed.

Step 1: Organizing inputs

Assemble all the required materials in a clean place. This must be clean and free of dust and possible contaminants like chemicals, physical objects and air pollutants. The place can be sanitized using commercial disinfectants. Methylated spirit, Jik, Detol, Jezyetc..have all given us satisfactory results.

Photo 8;
common disinfectants t
Dorcas

STEP 2: Priming the Substrates

A suitable substrate (cotton hulls, maize cobs, dried grass, wood clippings or garden straw) is selected. Course material can be chopped into smaller pieces. It is then weighed and thoroughly mixed with commercial lime. The liming helps to raise the PH of the substrates which are always acidic. The mushroom strive best at neutral PH (7). About 500g of lime is required to treat every 50kg of the dry substrate. Picture with illustrations.At this stage litmus paper can be used to test its PH. If PH is too low more lime is added.

Step 3: Wetting the substrate

Add clean water and thoroughly soak the substrate. At least 50% by weight or volume of water is required to make the substrate wet enough. Properly wetted substrates contain moisture of 40-50%. When it is squeezed hard in a hand fest only one or two drops of water come out it.

Picture 7:
Testing for the
right moisture content

The amount of water in the substrate can be controlled by drip drying the material on racks or slanted grounds. For very dry materials, water is splinkled over until the substrate is of the right consistency.

Step 4: Enriching the substrate

Add nutritional supplement. Wheat, rice or maize bran are often used with good results. About 2Kgs of bran are required for 50-60Kg of the wet substrate.
Picture with illustrations.

Picture 1-

The bran must be thoroughly mixed. The best approach is to first mix the bran with a small amount of the substrate, 10 or 20 kgsat first are enough. Then the stock material made is mixed with all the remaining substrate.
Picture with illustrations

Step 5: Sterilizing substrates

The substrate is heated using steam under pressure for up to 4 hours to kill all micro-organisms in it. This is best achieved by filling the substrate into plastic or gunny bags and placing them in a metallic drums with some little water at the base.

Picture 1-

The bottom of the drum is provided with an inner rack at the base to ensured that the substrate does not touch water. Alternatively the materials can be boiled and the excess water drained by tilting the drum and letting it stand overnight.

The top of the drum is then covered with heat resistant materials which is tied up with heat resistant rubber strips to made an air tight heat chamber.A small hole is made in the top to allow excess steam escape.

Food material that takes long to cook like banana, cassava or potatoes can be place at the top of the chamber to monitor temperatures.

When the food is sufficiently softened it will indicate that the substrate is also sufficiently cooked.

Step 6: Packing the substrate

The substrate is left to cool undisturbed in the steam chamber by removing the heat source. This can take up to 2 days. Taking the necessary biosafety measures the substrate is removed in small amounts and tightly packed into black polythene bags. About 5kg of substrate and 150g of mature spawn are required per bag. The substrate and spawn must be properly mixed. To achieve this, pack two or three inches of straw into the plastic bag and then lightly sprinkle the spawn on top. Repeat this until you've almost filled the bag. Compact the materials and close tightly.

Finally, aeration points are made into the substrate by perforating the polythene bags using sterile sharp instructions. Local materials like tooth picks can be used. One hole per square centimeter is enough.

Photo 9: Compacting substrate tightly

Step 7: Incubation/Spawn Run

The bags (gardens) are placed in a dry, cool dark room for 14-21 days. The right temperature is about 25 Degrees Celsius. During this time the spawn will grow out and colonize the entire substrate. If the growing is going right, the materials will change from being daffy to resonant on percussion. The polythene material will also develop a rough surface and wrinkle upwards. Later pin like protrusions will develop through the holes poked into the bags (pinning stage).

Photo 10: Removing substartes from a simple dark room

Step 8: Fruitification

At the pinning stage, the ready bags or gardens are removed from the dark room into an open space in the mushroom house where they are provided with proper aeration, a stable low temperature (18-23 Degrees Celsius), high humidity (very critical) and limited light.

Step 8: Harvesting

The mushrooms can be harvested after every other day. Care must be taken not to damage the gardens. The mushrooms are harvested before they are fully uncurled by holding the mushroom by the stalk and twisting other than pulling them out. It is good to remove all mushrooms growing in a cluster at once.

Picture 7: Testing for the right moisture content

The gardens remain productive for about 2 months but they sprout in waves. The first crop is normally the biggest and the farmer can pick up to 1Kg per garden. The next harvest is about half the first and so on. A good garden can produce up to 2Kg of its 3Kg total weigh. All mushrooms must be harvested at the right age. This sis indicated by cups facing towards the base of the stalk.

Delays in harvesting mushrooms result in release of spores with a drastic weight loss. Quality is also compromised by reduction in the mushroom shelf life, colours changes occur, and the mushroom get more fibrous. The spores can also at times cause allergy in certain humans.

The mushrooms picked must be weighed and processed for packing or drying immediately.They are highly perishable. Their protein-rich materials can quickly decompose and attract insects like house flies.

Fresh mushrooms have limited shelf life. This can be extended by packing the mushroom loosely in plastic bags or refrigeration at 2-4 Degrees Celsius.

The mushroom can be processed and preserved to stay longer by:

1. Sun or solar dying.

The mushroom are cleaned and cut into small pieces and exposed. They will be able to dry 2-3 days. Next seal the dry mushroom in polythene bags.

2. Canning them under vegetable oil.

The mushrooms are placed I container covered with edible oil and sealed.

3. Salting (Brining).

A solution of concentrated common salt is prepared and the mushrooms are dipped for several days. Before they eaten the salt is reduced by soaking them in clean water.

Picture with illustrations

DISEASES AND PESTS IN MUSHROOMS

In Uganda there are very few diseases that affect mushrooms. But pests like; insects, snails, and small animals such as rodents are common nuisances in the mushroom houses and dark rooms.

However, they can all be controlled by the management through improving the housing conditions.
The mushroom house can be made vermin proof while the insect can be expelled by regularly smoking the mushroom house, once a week is enough.

TROUBLE SHOOTING

Failure to fruit uniformly:To shock your mycelium, which will force it into fruiting, move the bags to a cool place for a day, such as a basement or other cool place.

Abnormal Fungi Growth: These are common in the environment and can appear in the mushroom house at any stage.

They normally cover the surface of the substrate and are visible as dark or e. blight as points of change of colour or course protruding materials. The fungi problem can be controlled by maintaining high levels of sanitation and hygiene, especially in the incubation phase. It the problem persist the mushroom house is for at least 1 week and fumigated using formaldehyd

Bacterial Attacks: These occur when the substrate is not properly sterilized or it is contaminated before it is colonized by the growing spawn. It appears as rotting substrates in most cases. Bacterial infection is encouraged when the substrate prepared is left with too much water or it incubation conditions are too humidity.

To control the diseases ensure that the substrate is not too wet and the incubation areas are dry. All infected materials must be removed and destroyed.

Viruses: these are indicated by failure of the spawn to grow and fruit well. There will be slow growth at al stages and reduced yields. The problem is often related to the labatories where spawn is produces. It can be avoided by sourcing spawn from well-established quality spawn producers.

BUSINESS ASPECT FOR STARTER

Capital Item

1. Setting up a simple mushroom house with - 300,000/=,
2. Small hand spray pump for spraying and sprinkling water onto gardens 7,500/=,
3. Metallic Drum (200 Litres) for holding water and boiling substrates - 60,000/=,
4. Gunny bags/sacks for holding substrate during boiling - 10,000/=,
5. Black Polythene materials for darkening incubation area- 5,000/=,
6. Nylon strings for hanging up gardens 3,000/- and
7. Plastic Jerrycans (20 litres) for fetching water 20,000/=.

Variable costs for consumables making 50 gardens

1. Disinfectants- Methylated spirit (500mls) or Jik 1litres – 2,500/=,
2. Gardening Black polythene bags - (1 packet)- 6,000/=,
3. Selected locally available substrate -1 bag cotton hulls or crushed maize combs (about 35Kgs)- 25,000/=,
4. Ready-to-inoculate good spawn – 4-5 kgs -50,000/=,
5. Building lime – 500g- 250/=,
6. Nutritional supplement- wheat, rice or maize bran (2kgs)- 1,200/=,
7. Fire wood or charcoal - 5,000/=,
8. Water- 5 Jerrycans (100 Liters)- 2,500/= and
9. Tooth pick for poking holes - 2,000/=.

Main recurrent costs

Water - one Jerrycan (20 liters) per day @ 500/= for 2 month= 30,000/=

Gross Income

Fresh Mushrooms; 25 Gardens each 2Kgs at 4,000/= per Kg of fresh Mushrooms = 200,000/=

Estimated Gross Profits

Gross income (200,000/=) – total variable costs (30,000+70,000) = 100,000/= (Gross profits)

IMPORTANT RECORDS

Records must be kept as a standard practice in food processing. This helps to monitor stock, production and to easemanagement. Space must therefore be created where records can be made so that data capture is in real time.

Records are important in mushroom production because they:

1. Help to plan orderly and properly.
2. Assist in budget analysis in procuring essential inputs.
3. Can be used to identify key production constraints.
4. Are critical in monitoring and evaluation of project.
5. Enable the producer to make correct management decisions.