Food and Agriculture Organization of the United Nations

Indoor oyster mushroom cultivation for livelihood diversification and increased resilience in Uganda

Source	FAO
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Country of first practice	Uganda
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Sustainbale Development Goals	No poverty, zero hunger, decent work and economic growth and life on the land

Summary

This practice describes indoor mushroom (*Pleurotus spp.*) cultivation as a means to diversify livelihoods and strengthen the resilience of farmers in Uganda. Indoor mushroom cultivation was promoted by the Global Climate Change Alliance (GCCA) project on Agriculture Adaptation to Climate Change in the central cattle corridor of Uganda.

Mushrooms can be grown at very low cost and in a relatively short time. It is a practice that can be adopted by small-scale farmers to diversify their income during the dry season, when lack of water may challenge the cultivation of other crops, and reduce their vulnerability to adverse weather. Indeed, mushroom production is done indoor, and it requires little amounts of water compared to other crops.

Description

1. Steps describing how to cultivate mushroom indoors

1.1 Mushroom spawns

Mushrooms are grown in 'gardens' where the spawns are inoculated. The spawns are filled into sterile glass bottles through a process that requires specific tools and knowledge. Farmers can either buy mushroom spawns from specialized producers at local markets or be trained for producing mushroom spawns themselves.

Figure 1: Mushroom spawns in a sterile bottle

1.2 Substrate

Agricultural waste (e.g. from sorghum, millet, beans, peas, wheat, maize, etc.) or cotton waste can be used as a substrate to grow oyster mushrooms. The agricultural waste, which is easily available on farms, is soaked for three days and then heaped for fermentation for four to six days in a closed container. After the fermentation

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Figure 2: Agricultural waste being soaked

process, the agricultural waste is sterilized through boiling in closed pots for 12 hours in order to eliminate unwanted organisms and bacteria. After cooling, it is filled in small polyethylene plastic bags using common bowls, to serve as a substrate. The substrate should be composed by 65 to 75 percent of moisture, and for the remaining part by agricultural waste. It can be used for three harvests, and then it can be recycled as organic mulch or fertilizer. Alternatively, cottonseed waste can be used as a substrate for the oyster mushroom production.

1.3 Inoculation

Polyethylene plastic bags are filled with the substrate (about 5 kg per bag), which is then inoculated with the mushroom spawns (spawns are ‘mixed’ with the substrate). Each garden of about 5 kg of the substrate is filled with about 250 g of spawns. Then, the plastic bags are closed manually.

1.4 Incubation

Following the inoculation process, the mushroom bags are hung in locally built (brick or mud walls and thatched roof), darkened mushroom houses for incubation. The ideal humidity of the incubation room is 70 to 75 percent. Each room can host up to 300 gardens.

Figure 3: Plastic bags are being filled before inoculation

1.5 Harvest

The mushrooms start sprouting after about 28 to 35 days from inoculation.

Each mushroom garden (i.e. plastic bag containing about 5 kg of substrate) yields a minimum of 2 kg of fresh oyster mushrooms.

Figure 4: Mushroom house

1.6 Drying and packing

Harvested mushrooms can be sold fresh, or they can be dried in a solar dryer and packed into plastic bags for sale.

2. Major costs and resources needed to cultivate oyster mushrooms

The approximate production costs per average mushroom garden (about 5 kg of substrate) yielding about 2 kg of fresh mushrooms are the following:

- cost of polyethylene bag: UGX 25 (USD 0.007) per bag;
- cottonseed waste: UGX 7 000 (USD 1.92);
- mushroom spawns: UGX 3 000 (USD 0.82); and
- labour: UGX 115 (USD 0.03).

2.1 The approximate upfront capital costs required to start mushroom production are the following:

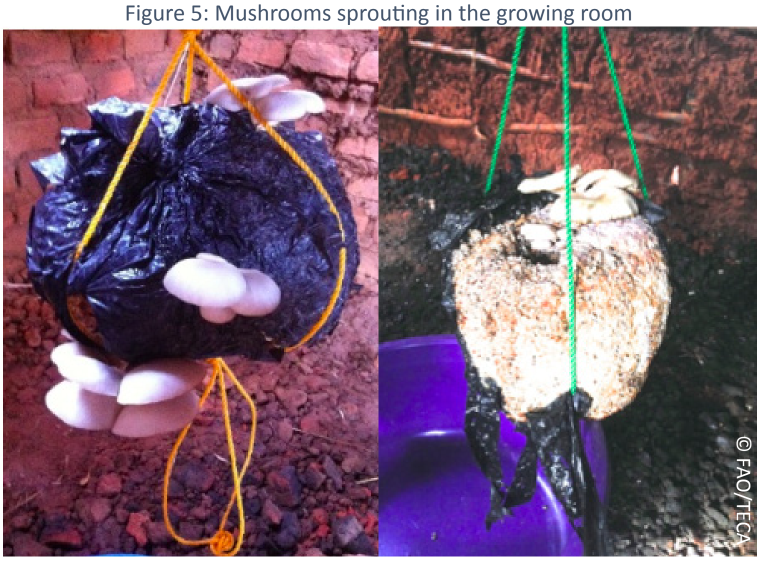
- growing room: UGX 800 000 (USD 219.12); and
- solar dryer: UGX 700 000 (USD 191.73).

2.2 Mushroom market prices:

- dried mushroom: UGX 30 000 (USD 8.22) per kg; and
- fresh mushroom: UGX 8 000 (USD 2.19) per kg.

The costs, prices and exchange rates mentioned in this practice refer to the time of writing (May 2017).

Figure 5: Mushrooms sprouting in the growing room



3. Cost-Benefit Analysis of the practice

The performance of indoor mushroom cultivation was assessed at farm-level in Uganda. The net benefits obtained from producing mushroom in the central cattle corridor of Uganda were calculated through a cost-benefit analysis (CBA).

The CBA calculates the net present value (NPV) of cumulative benefits obtained from an average mushroom house over a period of 11 years (10 percent discount rate is applied to express the future value of costs and benefits in present terms), as well as the benefit-cost ratio (BCR), which is the ratio between total discounted benefits and total discounted costs over the appraisal period. Since mushroom cultivation was not previously practised in the monitored farms, control plots were not available to conduct a comparative analysis. As an alternative, the opportunity cost of agricultural labour was used, i.e. the income foregone by not employing the labour used for mushroom production elsewhere.

Figure 7 and Figure 8 provide an overview of the outcome of the CBA. In particular, it shows that:

- In dry spell conditions (Figure 7), the net benefit of mushroom growing over 11 years is more than seven times higher than the opportunity cost of labour. The BCR in dry spell conditions is 4.7.
- In non-hazard conditions (Figure 8), the net benefits from mushroom growing are more than nine times higher than the opportunity cost of labour. Mushroom growing in non-hazard conditions brings USD 5.3 per each US dollar invested.

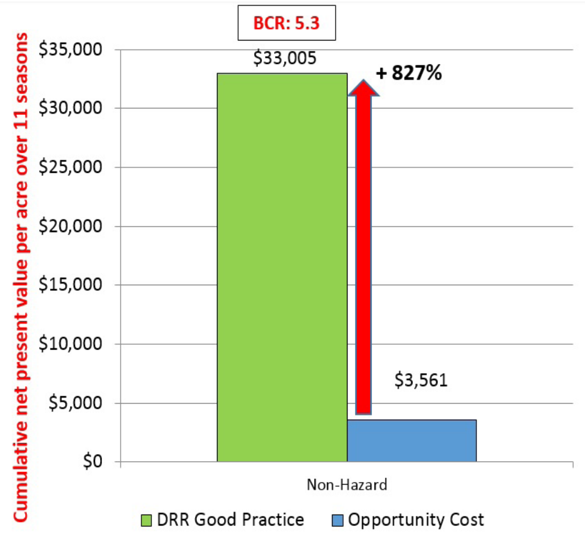
These results show that mushroom production is an effective livelihood diversification practice. Under the opportunity cost scenario, it is assumed that all labour (including family labour) needed for mushroom production would be absorbed by the local agricultural labour market otherwise. Under dry spell conditions, however, it is reasonable to expect that agricultural employment opportunities would be limited, thereby making mushroom growing an even more attractive option.

4. Socio-economic and ecological benefits

The sale of mushrooms in local markets provides an additional income source to

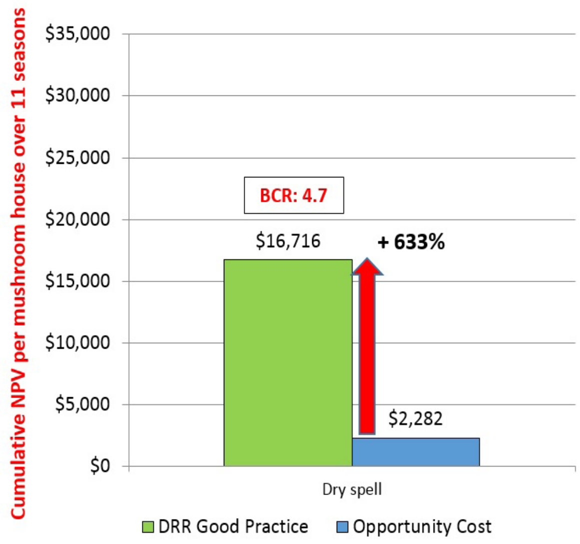
Figure 6: Solar dryers for mushrooms

Figure 7: Cumulative Net Benefits and Benefit-Cost Ratio of mushroom cultivation as compared to the opportunity cost of labour in farms affected by dry spell, 2016-2026



Source: FAO 2017

Figure 8: Cumulative Net Benefits and Benefit-Cost Ratio of mushroom cultivation as compared to the opportunity cost of labour in non-hazard conditions, 2016-2026



Source: FAO 2017

farmers and strengthens food security of the most vulnerable rural households.

This is even more evident in dry seasons, when lack of water may challenge the production of other crops. Nine of the interviewed farmers (67 percent) found that the practice provided better and more diverse food to the family.

The limited work effort required to grow mushrooms makes this practice accessible to men, women, the elderly, as well as people with disabilities. In Uganda, women play a central role in mushroom production. Furthermore, mushroom cultivation uses a limited amount of natural resources such as water and land, compared to other crops cultivated in the area.

5. Disaster Risk Reduction and Climate Change Adaptation-related benefits

Since indoor mushroom cultivation requires a limited amount of water compared to other crops, this practice contributes to Disaster Risk Reduction and Climate Change Adaptation in dry areas where decreasing average rainfall may lead to more frequent and more prolonged dry spells.

6. Difficulties and/or limitations

Three beneficiary farmers (out of 14) expressed concerns regarding access to inputs. In particular, mushroom spawns should be made available in local markets to maximize the benefits of this practice

7. The geographical area of practice validation

The practice was validated and implemented in the central cattle corridor of Uganda. In particular, farmers started growing oyster mushrooms in addition to common crops in the districts of Kiboga, Mubende, Sembabule, Nakaseke, and Nakasongola.

8. Context of implementation

This practice was validated and introduced by the Global Climate Change Alliance (GCCA) project on Agriculture Adaptation to

Climate Change in Uganda. All interviewed farmers (14 households) said they would continue to implement the good practice since it increased resilience and provided additional food to the family. Farmers said that there is a demand for mushrooms in the area, and they are generally able to sell mushroom (dried or fresh) in local markets.

However, it is possible that the activities required for mushroom production are conflicting with work in the field.

8.1 Environmental and climatic (period/ season) context

The performance of the good practice was monitored over a three months period during the 2016 dry season (June to August). Most farms were affected by dry spells during the monitoring period. In particular, rainfall was between 50 percent to 100 percent below normal in August, and land surface temperatures were 3 to 7 °C above average, causing a reduction in water availability.

8.2 Social–target group

Smallholder farmers.

9. Necessary basic conditions for a successful implementation

A warm and humid climate is suitable for indoor oyster mushroom cultivation. The existence of a demand for mushrooms is key to ensure the success of the practice.

10. Constraints (limiting factors) for the implementation of the technology

No major barriers were identified except the availability of mushroom spawns in local markets.

11. Agro-ecological zones

- Tropics, all
- Subtropics, warm/mod cool
- Subtropics, cool