

# Oyster Mushroom Cultivation

## Part III. Mushrooms Worldwide

### Chapter 10

#### Regional Research

## MUSHROOM CULTIVATION IN KENYA

**Justus Wambua**

Community Supporting Group, Kenya

### Introduction



Figure 1. Map of Kenya

Kenya is a medium-sized, East African, tropical country with a total land area of 582,646 sq. km. The equator cuts the country in half so the sun is usually directly overhead. This third world, Sub-Saharan country has a population of 30 million people.

Kenya's economy, like those of its neighbors Uganda and Tanzania, largely depends on agriculture. Kenya has a diverse climate that allows for the growing of many agricultural crops like coffee, tea, maize, wheat, rice, sugarcane and cotton all the year round. We intend to use the residues from many of these agricultural crops as substrates for growing mushroom for both commercial purposes and home consumption.

The Kenyan people are diverse, and the country's population is made up of 42 different indigenous tribes, each of which has different eating habits. Among these, 38 tribes are known to use mushrooms as food. Apart from these indigenous tribes, the population also includes many immigrants and visitors mainly of Asian, European and American origin. It is also immigrants and foreign visitors for whom many hotels here prepare mushroom dishes. But more local people are now trying these mushroom dishes and are discovering that mushrooms are both tasty and full of nutrients.

Kenya is an active tourist destination and offers beautiful beaches along the Indian Ocean and vast savannahs rich in wildlife. These attractions lure many tourists throughout the year, and this creates a great demand for mushrooms in the hotels. Agricultural products provide Kenya's primary income, but tourism is the second major income source. Part of mushroom production in Kenya does make its way to the leading supermarkets in major towns like Nairobi and Mombasa, but the current local Kenyan production does not meet the total demand for mushrooms and must be supplemented by canned mushroom imports.

The mushroom industry in Kenya is still in its infancy and is growing slowly. To many people, mushroom growing is still a myth because there is a lack of communication between the researchers in this field and the farmers, and the exchange of cultural knowledge is rather poor.

The mushroom that is commonly grown here is *Agaricus*. Its cultivation is highly sophisticated and requires a lot of capital, which discourages most potentially interested farmers. There are a few very-small scale producers of

oyster mushroom and shiitake in Kenya, but the few people with the knowledge of how to grow mushrooms here keep it secret and usually charge a lot of money to educate any interested farmers. This has caused slow development of the industry in a country that has a great potential for producing mushrooms.

### Current Kenyan Mushroom Industry

There are several commercial mushroom farms here in Kenya. They include Agridutt Ltd., Rift Valley mushrooms, Olive mushrooms, and Devani and Kanchan mushrooms. There are also other small farms producing mushrooms but only the four major farms have their produce sold in the supermarkets. Small farms usually sell their produce in the hotels and restaurants.

The current producers can hardly meet the demand in the supermarkets and sometimes the supermarkets run out of stock of the mushrooms. It is important to note that the four major producers are just medium-sized farms with limited capacities for production.

Three types of mushrooms, including *Agaricus*, oyster mushrooms and shiitake are grown here, and the button mushrooms account for over 95% of the mushrooms production volume. Only *Agaricus* is sold fresh in the supermarkets. Only on very few occasions have fresh oyster mushrooms been sold in the supermarkets. Shiitake are usually sold directly to the hotels and individuals.

The price of mushrooms is very high compared to that of other vegetables. Due to the low supply the price has remained unnecessarily high. In the supermarkets, *Agaricus* is sold in 250g packs at a price of KES\*150 (USD2). The price for the oyster mushrooms is comparable to that of *Agaricus* but shiitake costs as much as KES1,000 (USD13) for one kg of fresh mushrooms. Many poor Kenyans earn less than a dollar a day so they cannot afford a meal that makes use of these expensive mushrooms. For purposes of comparison, 250g of beef costs approximately USD0.5.

Establishment of traditional commercial-scale farms requires a huge initial capital investment, so smaller farmers are hard to grow mushrooms in a commercial scale. The commercial farm's technical expertise comes from personnel who have been trained abroad in countries where mushroom farming is popular. To start a medium-sized farm would require a capital investment of around KES40 million (USD520,000). This includes construction of mushroom houses, purchase of the land, purchase of the machines used for compost preparation, installation of air conditioners, acquisition of spawn, educating staff abroad, and many other costs related to mushroom production. These costs could be lower for a person who had the knowledge concerning mushrooms cultivation because many of the required systems could be improvised to lower the initial investment.

Many farmers interested in growing mushrooms here do not have a lot of capital and cannot afford to hire trained personnel. The greatest problem, though, is the lack of availability of mushroom spawn. There is not even one single spawn manufacturing company here in Kenya. Interested farmers have to either import spawn or use cultures from culture collections to make their own spawn.

Spawn making requires well-trained personnel in order to keep the quality high. Culture preservation is not easy for small farmers and after a few months the quality of spawn diminishes so they need to continually import the cultures in order to remain in the business (Fig. 2, 3). The quality of the spawn they make themselves is also usually low and this translates to poor yields. Mushroom growing technicians who have trained abroad are expensive, a significant portion of the businesses investment.



Figure 2. Cultures stored in a cabinet at room temperature. Small farmers cannot afford the methods of culture preservation



Figure 3. A collection of cultures stored in a refrigerator. The cultures normally lose their vigour after six months of storage. This may be due to electricity power fluctuations which are very common and prolonged.

This writer knows of several people working in the commercial farms who have received training in Japan, Britain, France and Belgium. Few local farmers are able to go abroad for training and are discouraged from entering the mushroom cultivation business as a result.

Most commercial farmers import expensive spawn from other countries. Mushroom spawn usually costs KES600 (USD7.8)/kg including the airfreight charges.

Mushroom farmers keep their growing procedures highly secretive and access to the farms is highly restricted. As a result, the exchange of information is very poor and it is even difficult to ascertain the total production of mushrooms from these farms. This writer has personally been denied entry many times to the commercial farms. These mushroom establishments will summon mushroom experts only when problems such as diseases threaten their production.

The personnel employed in the farms can be divided into two groups. The first group includes the well-trained, well paid managers and technicians. More than half of the money a farm pays out as wages and salaries goes to this group. A single commercial farm could usually have only two people with such advanced training. The other group involved in the actual production is the workforce that provides the unskilled labour, and their number could be as high as 50 in big commercial farms. In order to increase their profits, most farms pay these people meager wages, and since the farms belong to rich owners who pay low wages to their workers, there is very little that these types of mushroom farming operations can do to change the economic situation of the people in the regions where they operate.

It is estimated that the current production of mushrooms in Kenya is 500 tons per annum, which is very low. Of this production, *Agaricus* mushroom accounts for 476 tons. Other mushroom species are not widely farmed. Some small farms exist that do produce around 20kg of shiitake within a period of one week (Fig. 4, 5, 6, 7). Oyster mushroom cultivation is not yet popular although there are four small farms with an average production of around 120kg each per week. The likely demand for the oyster mushrooms is not high because few people know about them. This explains why many commercial farmers don't grow oyster mushrooms. From an objective point of view, however, Kenya has the potential to produce over 100,000 tons of mushrooms every year.



Figure 4. Recently inoculated bags



Figure 5. Bags of sawdust inoculated with shiitake ready for fruiting



Figure 6. A pile of tree logs during spawn run



Figure 7. Logs producing a few mushrooms. The logs are kept inside a green house in order to fruit. The major challenge in this green house is overheating during the day. This problem is solved by shielding it from direct sunlight.

There are a few people in Kenya currently growing oyster mushrooms for home consumption. In August, 2003, a project was initiated involving over one hundred families whereby they grow *Pleurotus sajor-caju* at home in small spaces like their kitchens. The major aim of this initiative is to provide the people with alternative food sources to counter the problem of malnutrition in Kenya. Many people in the rural areas and the urban slums suffer from malnutrition because the prices of foods rich in protein and minerals are generally expensive.

Owing to the ease of growing, high yields, high fruiting temperature and high nutritional content, it was appropriate to introduce small-scale mushroom cultivation in Kenya. Today there are a number of farmers who have expanded because they grow more than what they can consume, they can market their surplus.

Among the 42 tribes in Kenya, some like eating mushrooms very much. Only a few tribes do not value mushrooms as food although they are also changing as nutritional awareness grows. In the rural areas, people collect wild mushrooms and prepare them traditionally with other foods for consumption. The most popular mushrooms collected are the *Termitomyces* and *Pleurotus* species commonly growing in the forests.

A portion of the Kenyan forests is lost each year due to deforestation, so the natural habitat for wild mushrooms

also decreases every year, and this has led to a decline in the collection of mushrooms from the wild. A large percentage of the Kenyan population, especially those living away from wild mushroom habitats, and those who cannot afford the mushrooms sold in the supermarkets, have never had the chance of eating mushrooms. There are still many delicious and nutritious species of wild mushrooms yet to be identified and possibly domesticated but this will depend on future research efforts.

Several species of *Pleurotus* have been domesticated from Karura, Kakamega and other forests. These species are more adapted to local tropical climate and generally grow fast and fruit readily, but it may take some time before they appear in the markets.

### **Recommendations for the Fast Growth of Kenyan Mushroom Industry**

- There should be a local producer of high quality mushroom spawn that could be sold directly to local farmers. The spawn manufacturer should also advise the farmers on which strains grow well in their particular localities because the country has diverse cold, moderate, and hot regions.
- The Ministry of Agriculture and other supporting institutions should give more emphasis to encouragement of mushroom cultivation. The Ministry does not currently have officers specifically assigned to mushroom extension services. The extension officers should be more accessible and less expensive than the present mushroom experts.
- Donors who usually shun projects involving new technology and huge amounts of money should give support to women's groups or small farmers to initiate small local projects for mushroom cultivation as a family food source. This would go a long way to solving the problem of malnutrition, particularly protein deficiency among children, and food insecurity that is common in Kenya.
- Exchange of information between farmers and researchers should be encouraged. The current mushroom farmers don't trust their competitors, and unfortunately neither do some researchers. This selfish and short-sighted attitude has inhibited the development of Kenya's mushroom industry. A research institution established specifically for mushroom research would greatly support the industry. There are research institutions for other crops like coffee, tea, pyrethrum from which the country earns a great deal of foreign exchange. For example, due to the enormous amount of research that has been performed concerning tea cultivation, Kenya has now risen to be the world's third largest tea producer.
- Promotions for the consumption of mushrooms should be undertaken. The Kenyan people should be taught the nutritional and medicinal attributes of mushrooms in order to encourage them to eat more mushrooms. There are still many people who have never eaten mushrooms. When this writer exhibited mushroom cultivation at the Nairobi International Trade Fair in October, 2003, he realized that some people didn't know that mushrooms are eaten as food. Many people do know about the poisonous mushrooms and this makes them fear eating any mushrooms, even cultivated mushrooms. These promotional campaigns would expand the local market and the growers would therefore be able to sell a large proportion of their produce here even before they exported the surplus.

### **Feasibility of Growing Mushrooms in Kenya**

- It is possible to grow mushrooms in Kenya but the growers will need to find solutions to the problems facing mushroom growers in this country. These problems are more or less similar to those in other third world countries and the approach could be compared to mushroom projects in these countries.

- Kenya generally has a tropical climate and most of the areas are hot, and these areas are suitable for *Pleurotus*. There are cold regions favorable for *Agaricus bisporus* and other mushrooms growing in cold areas.
- The lowlands are usually hot (21-34°C) and are generally poor in agricultural production. Though some of the lowlands receive adequate rainfall, the soils are poor and this results in small quantities of agricultural residues being available for use as substrates.
- Areas of moderate altitude that receive moderate rainfall (800-1,500mm per annum) are where most of the agricultural activities take place. Temperatures in these areas range between 18 and 27°C. This climate allows for the cultivation of a variety of crops such as wheat, rice, maize and cotton. And the agricultural residues suitable for use as mushroom growing substrates in these areas are plentiful.
- The highlands are generally cold, with temperatures ranging between 14 and 23°C. The highlands produce less agricultural residues but mushroom farmers can get their substrates from nearby moderate areas. The risk of contamination of substrates in the hotter areas is higher than the cool areas and the polythene bag technique is the most appropriate for oyster mushroom and shiitake cultivation here. In oyster mushroom bag cultivation, it is advised that the volume of the bags should not exceed 15L in order to avoid overheating.
- In the hot areas the mushroom houses should be highly insulated to keep the heat out. Mushroom houses made with locally available materials used as insulation and covered with polythene are suitable for farmers with only small capital investments.
- In order to fight temperature fluctuations, the commercial farmers should build mushroom houses using concrete and use air conditioners to regulate the environment inside. In cold areas the temperature at night falls to as low as 4°C which would inhibit the growth of mushrooms.
- Substrates for growing mushrooms are plentiful in areas where wheat and rice are grown in large scale. Other substrates like sawdust, sugarcane bagasse, corncobs, coffee pulp, cotton wastes and other straws are also available. The country is a big producer of agricultural produce so the availability of any of the substrates is not a problem (Fig. 8).
- Straw burning is a common practice. Wheat straw is sometimes baled and used as animal feeds but in some areas it is burned as a means of disposal. Rice straw, like other straw, is also used as animal feed. Rice bran and wheat bran produced in the processing industries are used as animal feed and are sold at inexpensive prices.
- Sawdust is available free of charge from the lumbering yards. Only in a few areas is it used as fuel. This may change very soon because the government has recently banned cutting down of forests for timber. Sugarcane bagasse is available for free from the crushing industries and the locals do not currently have a way of making use of this residues.
- Most farms are located near the markets and they can therefore easily supply the markets with fresh mushrooms. Mushrooms are currently produced only near major towns because people in the rural areas cannot afford them. People in the rural areas collect their mushrooms from the wild. First quality fresh mushrooms are supplied to hotels and supermarkets with second grade mushrooms being sold to lower markets at a cheaper price.

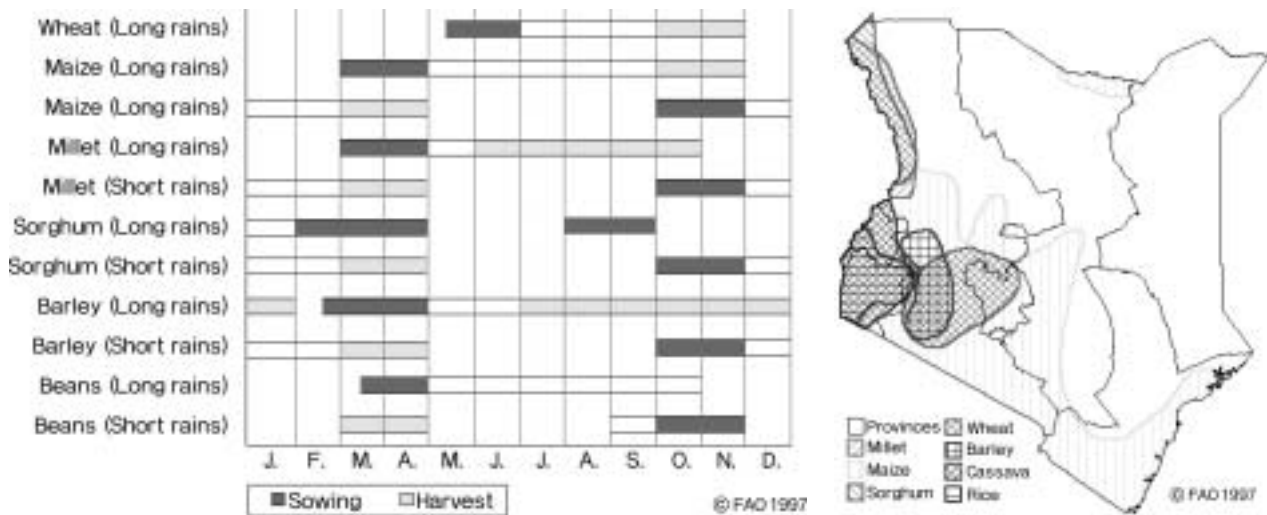


Figure 8. Crop calendar and main crop zones of Kenya

- Some companies do canning of their mushrooms but the canned Kenyan produce is not sold in the supermarkets. There could be other outlets currently being used, but the companies always keep their activities secret. Canned mushrooms imported from Europe are sold in the supermarkets and food stores to supplement the local production. Dried mushrooms are also available here. It is worth noting that the proportion of both dried and canned mushrooms is very small compared to the fresh mushrooms consumed.
- There is a great possibility of producing mushrooms here and exporting to other countries. It is the policy of the government to attract investors into the country and set up industries to ease the problem of unemployment. Companies intending to export produce are greatly encouraged because this earns the country foreign exchange credits.
- Importing of mushrooms does not account for a major proportion of the mushroom consumption. More promotion of mushrooms as a nutritious food item has to be done to increase local consumption before more imports can be made. What would be more beneficial to the country is to encourage more local production to meet the local demand.
- Consumption of mushrooms in Kenya is not high. In the hotels, the mushrooms are cooked by chefs who cook them in combination with other ingredients to suit the taste of visitors and customers. Many local people simply fry and mix them with meat and vegetables. Some people who collect wild mushrooms roast them before eating. Some wild mushrooms are dried and ground together with maize or sorghum for making porridge fed to babies, pregnant women and nursing mothers.

## REFERENCES

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