**Pests of roses**

- **Rose aphids**

Nymphs and adults are found in clusters on the tender shoots, flowers and buds and suck the sap. Buds fall off pre-maturely and the flowers show fading.

**Control:** spray with recommended pesticides.

- **Thrips (Thrips tabaci)**

Nymphs and adults lacerate the tissues from the under surface of leaves.

They suck the sap that oozes out.

White steaks appear on the infected leaves.

Infected flowers don't open; flowers fade and fall down prematurely.

**Control:** Spray with recommended chemicals.

- **Leaf cutter bee**

It makes neat circular or oval cuts on the leaf margins. It uses the cut bits to construct its nest cells.

**Control:** Spray with recommended insecticides. Breeding sites should be eliminated.

- **Termites**

Feed on roots of young and old plants. Affected plants wither, dry and ultimately die.

**Control:** Mix lindane dust with soil. Drench the soil with lindane 2ml/ Liter of water.

**Diseases of roses**

- **Black spot**

Causes black lesions with feathery margins surrounded by yellow tissue on the leaves.

Infected leaves drop prematurely.

Control

- Remove infected canes and burn diseased leaves.
- Spray with copper dust.
- Proper spacing for proper air circulation, avoid overhead watering and keep foliage as dry as possible.

- **Die back**

Symptoms

- Dying of twigs from the tip down wards.
- Blackening of the twigs.
- The disease spreads to the root and causes complete death of the plants.

Control

- Pruning so that lesions on the young shoots are eliminated.
- Spray with recommended chemicals.

- **Rust**

Lemon yellow pustules appear on lower surface of the leaves and stem. Then the colour changes to blackish red.

Affected leaves turn yellow deformed and fall prematurely

Die back symptoms also appear due to weakening of the plant.

**Control:** Collection and burning of fallen leaves. Spray with recommended chemicals.

### 14.4.2 Mushroom Growing

Mushrooms belong to the kingdom of **Fungi**, a group very distinct from plants, animals and bacteria. Fungi lack the most important feature of plants: the ability to use energy from the sun directly through chlorophyll. Thus, fungi depend on other organisms for food, absorbing nutrients

from the organic material in which they live.

**Fungus ecology**

Fungi depend on other organisms for their food. Three modes of living can be recognized i.e.

- **Saprophytes**: these degrade already dead material.
- **Symbionts**: these live together with other organisms (especially trees) in a close, mutually beneficial relationship
- **Parasites**: these live at the expense of other organisms. They extract their nutrients from other organisms.

Mushrooms, though classified as vegetables in the food world, are not technically plants. They belong to the fungi kingdom and although they are not vegetables, mushrooms provide several important nutrients.

**Commonly cultivated edible Fungi include**

| Common name | Scientific name |
|---|---|
| Button Mushrooms | *Agaricus spp.* |
| Oyster Mushrooms | *Pleurotus spp.* |
| Shiitake | *Lentinula edodes* |
| Reishi or Ling Chi | *Ganoderma lucidum* |
| Lion's Mane | *Hericium erinaceus* |
| Nameko | *Pholiota nameko* |
| Ears | *Uricularia spp.* |
| Chicken-of-the-Woods | *Polyporus sulphureus* |

**Varieties of Oyster mushrooms grown**

| Common name | Scientific name |
|---|---|
| Gray oyster mushroom | *Pleurotus sajor caju.* |
| Cherry oyster mushroom | *Pleurotus cystidiasus* |
| King oyster mushroom | *Pleurotus eryngii* |
| White oyster mushroom | *Pleurotus florida* |
| Yellow oyster mushroom | *Pleurotus citrinopileatus* |
| Pink oyster mushroom | *Pleurotus djamor* |

**Importance of oysters/ mushrooms**

- Mushrooms are rich in vitamin B, vitamin D, minerals, have very low carbohydrates, unsaturated fat and adds immunity to HIV patients.
- Mushrooms offer medicinal importance; they are important in liver disorders, diabetes, asthma, respiratory disorders, hepatitis B, hypertension management, obesity, normalize cholesterol levels, increases ATP production, strength and endurance, and has anti-aging effects, Breast Cancer & Prostate Cancer presence of Beta-Glucans and conjugated Linoleic Acid, which both have anti-carcinogenic effects, ulcers, blood pressure and bone health.
- Immune system strength: Ergothioneine, a powerful antioxidant present in mushrooms, is very effective in providing protection from free radicals as well as boosting the immune system. They contain natural antibiotics (similar to penicillin, which

itself is extracted from mushrooms), which inhibit microbial growth and other fungal infections.
- Mushrooms are sold for income by the farmers hence boosting their earnings.

**Factors considered when choosing the mushroom species to grow**
- The **waste materials** readily available to use as a growth medium; Oyster (*Pleurotus*) grows best on rice straws, wheat straw, cotton wastes and coffee pulp while Shiitake (*Lentinus*) grows best on logs.
- **Available environment** for growing the mushrooms; outdoor production of mushrooms require limited knowledge and demand for limited monitoring of the growth conditions for Shiitake (*Lentinus*) while indoor production of mushrooms requires manipulation of the growth conditions for species Oyster (*Pleurotus*).
- **Cost of equipment needed**; air-cleaning equipment or respirators are necessary in order to safely work in the production facility for Oyster since some farmers are allergic to their spores, mushroom driers and storage equipment.
- **Skill required to manage the life cycle** of the fungus; most shiitakes (*Lentinus*) and many other mushroom species are raised on a sterilized sawdust substrate. Although this method allows a much faster fruiting cycle and a high level of return (110% or more of initial dry weight), it demands a greater capital investment and more skillful management than log production.
- **Market demand for the species**; organically grown Button Mushrooms (*Agaricus spp.*), Oyster mushrooms (*Pleurotus spp.*), Shiitake (*Lentinula edodes*) are more marketable than other species.

**Advantages of oyster mushroom (*Pleurotus spp*) production**
- They require a small space to rise. This makes it possible to grow them in urban and peri-urban areas.
- They grow and mature fast thus giving fast financial returns (in 15 days).
- They have a high germination percentage thus high yields and profitability to the farmers.
- They don't require a lot of labour to manage indoors.
- They are not much affected by diseases and pests.

**Factors necessary for oyster mushrooms (*Pleurotus spp*) production**
- **Temperature**: the incubation period requires a temperature of 20°C – 30°C, and 15°C to 30 ° C at fruiting.
- **Humidity**: high humidity of 80-90% at fruiting to avoid drying out of substrate and the mushroom.
- **Ventilation**: both low oxygen and carbon dioxide concentration favors mycelia growth. At fruiting, the carbon dioxide concentration should be reduced since it leads to long-small stems with no caps.
- **Moisture content of substrate**: moderate moisture content of 70%. High moisture above 80% clogs air flow while too low water content below 60% prevents mushroom growth.

- **Light**: light is needed for fruiting. Little light leads to long stems and small heads.
- **Substrate**: fermentation of the substrate makes nutrients available to the oysters. Oysters grow well on a variety of substrates.
- **pH**: of the substrate; oysters require a medium pH of between 6 and 7.
- **Spawn**: good quality spawn (seeds) from high yielding and clean oysters are required.

**Challenges that face mushroom production in Uganda**

- Perishability of mushrooms that calls for cold storage and rapid processing or marketing. This causes high losses to the mushroom farmers.
- Low quality substrate due to inadequate skills in substrate preparation and preparation of the growing houses.
- Pests and diseases that attack the spawn especially those grown out door.
- Inadequate supply of quality spawn (seed) for raising quality organic mushrooms that are highly demanded on the market.
- Low prices for mushrooms given to the farmers by middlemen. The farmers who sale unprocessed mushrooms are given low prices and this discourages commercial oyster production.
- Harsh climatic conditions characterized by dry and hot conditions that discourage quality production of oysters.
- Indoor mushroom production requires a large supply of highly skilled labour and use of specialized equipment that are expensive to most farmers.
- Inadequate research and extension on mushroom growing in Uganda. This is because this is a new enterprise in Uganda and little has been about the species, diseases and pests of mushrooms.

**Factors considered when siting mushroom farms**

- Distance to the market; the site should be near the market since mushrooms are highly perishable and need to be delivered to the market immediately after harvest.
- Availability of good quality substrate material; the materials should be sterilized and highly nutritious to provide necessary nutrients for spawn growth.
- Transportation of both product and substrate material; the farm should be located near an accessible road for easy transportation of substrates and mushroom products to the market.
- Availability of clean water for wetting the substrate for spawn germination since mushrooms absorb whatever substance in the material they grow on.

**Note**

- Substrates that are commonly used in raising mushroom include: Wheat straw, pea nut straw, sugar cane waste, soya bean straw, sun flower waste, maize waste, logs, bagasse and molasses, horse manure, water hyacinth, paper, among others.
- It's important to eat ONLY organically grown mushrooms because they absorb and concentrate whatever they grow in.

- Mushrooms are known to concentrate heavy metals, as well as air and water pollutants, so healthy growing conditions is a critical factor.

**Steps followed to raise mushrooms**

- Chop the straw or substrate and soak it in clean water for 24 hours.
- Sterilize the substrate against any bacterial infections and pack in air tight polythene papers or casings.
- Introduce spores/ spawns (used for planting) and move casings to a dark incubation room and keep the substrate until it is covered with white growth.
- Keep the temperatures of the incubation room at around 11o C – 15oC and check the casings for any contaminations and discard if decomposing.
- Introduce little light and keep watering during growing period, raise temperatures to around 19oC and high humidity.
- After 3 weeks grown mushrooms are ready for harvest.

**Note**

To produce spawns; you inoculate a pasteurized medium with the sterile culture of a particular mushroom species. After the culture has grown throughout the medium, it is called **spawn.** After having colonised the substrate, the mycelium is capable of producing fruiting bodies. The number and quality of the fruiting bodies will depend on the environment.

**Precautions taken while raising mushrooms**

- Incubate in a dark room to encourage spawn growth.
- Do not introduce holes in polythene papers before white growth to avoid bacterial and fungal infection.
- Maintain moisture content of substrate to avoid desiccation.
- Moderate temperatures to avoid shrinkage and low quality.
- Do not water directly but introduce a mist to avoid rotting and fungal infection of substrate.
- Maintain favourable humidity to avoid desiccation.
- Harvest immediately to avoid rotting and lose of quality.

**Pest control**

- **Integrated pest management (IPM)** is a least- toxic approach for managing any pest. IPM views pests as a natural part of the farm environment. The integrated management of a pest is accomplished by altering the environment to the disadvantage of that pest.
  - Mushroom flies, a common pest among many cultivated mushrooms, are attracted to the smell of decaying vegetation such as mushroom substrates. Screening the mushroom house ventilation system will keep adult flies out.
  - Double doors and positive atmospheric pressure within the structure also prevent flies from entering. Since adult fungus flies are drawn to standing pools of water on benches, walks, or floors,

places where water can collect should be eliminated.

- **Biological control** e.g., the sciarid fly among them. A predatory nematode attacks this fly in its larval form. Therefore, this nematode can be added to the composting substrate to prevent infestation.

**Processing and marketing mushrooms**

The available marketing strategies include;

- Market the fresh or dried product directly to your customers.
- Add value to the mushroom by creating processed products (mushroom sauces, dried entrée mixes, teas, extracts).
- Wholesale as fresh produce (on contract or by the batch).

**Revision questions**

(a) What are the advantages of growing mushrooms compared to other crops?
(b) Describe the procedure of raising oyster mushrooms indoors as a high value crop.
(c) Explain the considerations made when choosing the species of mushrooms to be grown on the farm.
(d) Describe the post-harvest handling practices for pepper to maintain its quality.
(e) Discuss the agronomic practices involved in rising passion fruits up to harvesting.
(f) What conditions may lower the market value of passion fruits after harvesting?.

## 15.0 Agroforestry

This is the system of farming in which farmers plant trees that have multiple uses together with crops and/or pastures on the same farm land.

**Importance of agro forestry**

- Trees provide shade for animals.
- Legumes planted fix nitrogen in the soil.
- Trees are a source of fodder to livestock.
- Trees support crops with weak stems.
- Some trees provide fruits which are eaten by man.
- Trees shade off leaves that decompose to form humus in the soil.
- Trees are a source of firewood.
- Trees provide materials for construction of animal shelters.
- Dry leaves are used as mulching materials.
- Trees help in rainfall formation.

**Characteristics of a good agro forestry tree species**

- It should be able to fix nitrogen into the soil (leguminous).
- It should have a deep rooting system to absorb water and nutrients from deeper layers.
- It should have few extensive lateral roots on the top soil to reduce competition with associated crops.
- It should have a less dense canopy to reduce shading of companion crops.
- It should be adapted to a wide range of environmental conditions.
- It should be easy to establish and get rid of when desired.
- It should withstand repeated pruning
- It should be nutritious and palatable to livestock.