

Dear reader,

This is the planting season and as the saying goes, you reap what you sow. This calls upon farmers to ensure that they sow seeds of good quality to reap satisfactorily. For details on maize seed varieties suitable for your climatic region refer to TOF Issue No.188, published in the month of March 2021.

https://infonet-biovision.org/sites/default/files/pdf/tof_188_march_2021.pdf

This edition of TOF is rich with information on how farmers especially those in dry regions can adopt rain water harvesting and conservation techniques known as micro-catchment technologies to maximize on the little rains received.

Last year many farmers wanted to know about mushroom farming. This Issue of TOF provides all the information you need to establish a mushroom garden.

In every edition, we feature various pests and diseases that farmers often grapple with in the farm. This month, there is so much to learn about diamondback moth that has been frustrating vegetable growers and brucellosis, a disease that if mismanaged in livestock presents health risks not only to the animal, but also to the farmer and those consuming products from the animal. Only in your favourite Organic Farmer Magazine.



Micro Catchment Water Harvesting in Arid and Semi-Arid Areas

By Jean Paul Mackio

Irregular rainfall and recurring droughts are some of the characteristics of arid and semi-arid areas. On average, these areas receive rainfall of up to 700 mm per year. Most of the people living within arid and semi-arid areas rely on pastoralism and subsistence farming.

These activities face various limitations as a result of inconsistent rainfall patterns, heavy rainfall that is mostly lost through high rates of evaporation, and surface runoff. These reduce agricultural yields as crops and animals compete for scant reserves of moisture.

To manage these challenges, farmers can adopt micro catchment technology which is a water harvesting approach that can sustain rain-fed agriculture in dry areas.

Micro catchment rainwater harvesting is where by a farmer collects surface runoff directing it to the root zone of an infiltration area. The technology can be designed through:

- (i) Pitting
- (ii) Strip catchment tillage
- (iii) Earth basins
- (iv) Semicircular bunds
- (v) Meskat-type system
- (vi) Contour ridges
- (vii) Earthen bunds

Continued on Page 2

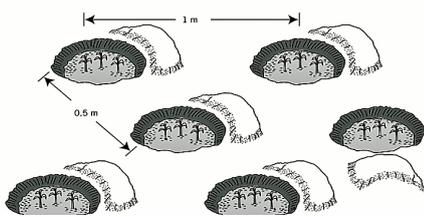


(i) Pitting

The pitting system refers to small circular pits 20 cm deep and 30 cm in diameter. The pits are dug to break the soil surface which is crusted in nature to store water while building up soil fertility. There are different types of pitting systems such as Tassa, Zai, Katumani, half-moon, chololo pits and planting pits. They can be used in areas with rainfall ranging between 350mm and 600 mm.

Zai pits encompass shallow and wide pits of 15-20 cm deep and 30 cm diameter. Four to eight seeds of crops are planted within the pits and organic manure or compost is added to increase fertility.

Chololo pits are made up of a series of pits that are about 30cm deep and 22 cm in diameter. The pits are spaced 90cm between rows and 60 cm apart with rows running along contours. The soil removed when digging the pits is used in making a bund around the hole.



(ii) Strip catchment tillage

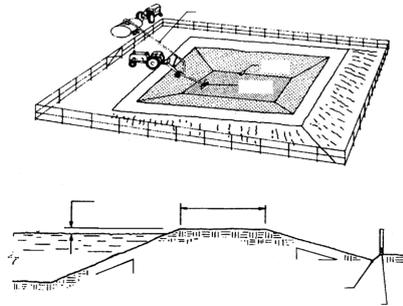
Strip catchment tillage involves tilling strips of land along crop rows. Suitable sections between the rows are left uncultivated to release runoff.

The technique is mostly used in gentle slopes to allow runoff from uncultivated areas to add water into the cropped strips. The basin-catchment area ratios are normally equal to or less than 1:2. The technique can be used in all types of crops.



(iii) Earth basins

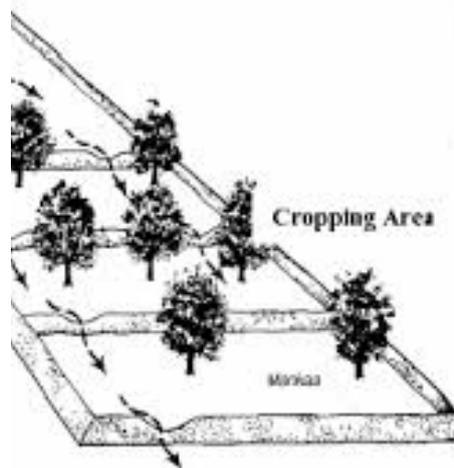
Earth basins refer to small, circular, diamond or square shaped micro catchments with the sole purpose of capturing and storing all the rainwater that falls within a farm for planting purposes. They are created by using low earth ridges on all the sides to enclose rainfall and runoff within the mini basin.



(iv) Meskat-type system

The Meskat-type technique involves the diversion of run-off water directly into cultivated land at the bottom of a slope. The farm is divided into two sections: the catchment section and the cultivated section.

The cultivated area is located immediately below the catchment area. The catchment area should be compacted. The suggested ratio between the cultivated area and catchment area is 1:2.

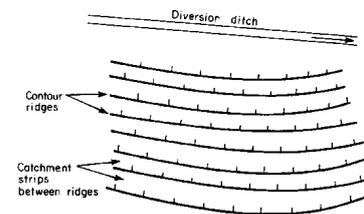


(v) Contour ridges

Contour ridges involve creating ridges along contours at a spacing of 1.5m to 2m. The ratio between the cultivated area and catchment area is, therefore, 3:1 to 2:1 respectively. The uncultivated strip between the ridges acts as the collection point of runoff.

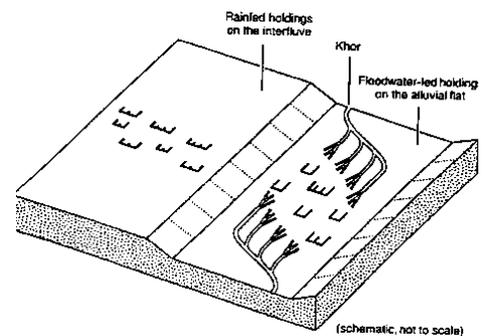
The water is then stored in the furrows just above the ridges.

Crops are planted on both sides of the furrows with cereals being seeded on the upslope side of the ridge, between the furrow and top of the ridge. An intercrop mostly a legume is planted in front of the furrow.



(vi) Earthen bunds

Earthen bunds refer to several forms of earth shaping which create run-on structures for ponding runoff water. The main design for earthen bunds includes creating earth bunds in a semi-circle shape with the tip of the bunds in the contour. The spacing of the contours and the dimension of the holes are determined by the type of crop being planted.



Benefits of Micro-Catchment Technologies

- Increased water availability.
- Minimized risk of production failure.
- Improved crop, tree and fodder production.
- Simple to design, construct and control.
- Erosion control while trapping nutrient-rich sediments from runoff.
- High runoff efficiency than medium or large-scale water harvesting systems.

The technologies can be used to sustain medium water demanding crops such as sorghum, groundnut, maize and millet among others.

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Brucellosis; threat to human and animal health

By Susan Wanjiru

What you need to know

Brucellosis is a devastating zoonotic disease that affects both humans and animals. It is passed from animals to people through unpasteurized dairy products. It can progress stealthily and can be missed by doctors and veterinarians.

Brucellosis is recognised as a disease of immense public health significance and is prevalent in many countries, including Kenya.

Which animals are affected?

The disease is caused by bacteria in the genus *Brucella* and affects grazing animals (herbivores). They contract the disease from bacterial spores found in the soil, which can survive for decades. It affects cattle, pigs, sheep, goats, dogs, and wildlife. Each animal species is infected by a specific species of bacteria.

Brucellosis in cattle is caused by *B. abortus*, in sheep and goats, it is caused by *B. melitensis* and in pigs, *B. suis*. However, some bacteria species can infect more than one animal species.

Humans usually contract the disease directly or indirectly from animals or animal products. Inhalation of spores from infected products can also cause infections in humans. Social-cultural practices such as the consumption of raw milk can fuel infections.

How is it transmitted?

According to the World Organisation for Animal Health (OIE), brucellosis is typically spread when an animal aborts or gives birth.

The bacteria localises in the reproductive organs of infected animals, and high levels of bacteria are found in the birth fluids of an infected animal. During birth, these fluids contaminate the environment. The bacteria shed can survive outside the animal in the environment for several months, especially in cool and moist conditions. They remain infectious.

Animals are infected when they ingest bacterial spores from the soil as they graze. The bacteria colonise the udder and contaminate the milk.



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Infected bulls have bacteria in their semen and can infect females. Cuts in the skin and mucous membranes can also serve as ports of entry for the bacteria.

In animals

Affected animals sometimes appear healthy, showing no signs of illness. In some cases, they may exhibit mild symptoms such as swollen testes, arthritis, and hyperaemic membranes.

Stillbirths, infertility, retention of the placenta, or the birth of weak offspring are indicative of brucellosis.

Generally, brucellosis reduces reproductive efficiency in healthy-looking animals and causes losses, especially in cattle and sheep farms.

In humans

In humans, brucellosis is also called undulant fever or Malta fever. Symptoms include recurrent fever, headache, weakness, profuse sweating, chills, weight loss and general aches.

Veterinarians, farmers, abattoir workers and laboratory workers are vulnerable as they handle infected animals, aborted foetuses, placentae and samples.

What should I do in suspected cases?

- Handle aborting animals and the abortus with caution.
- Use personal protective equipment.
- Always inform your animal health professional of any cases of abortion on the farm. Brucellosis is a notifiable disease and suspected cases must be reported to the authorities.

How do I treat or prevent brucellosis

Preventing infection in animals is preferred as there is no treatment. If your animal displays any of the signs, call a vet. The vet will collect samples and send them to the laboratory to confirm infection. Animals with the diseases should be culled.

The long-term goal should be to have and maintain a brucellosis-free herd. Vaccination is encouraged where applicable. Human brucellosis is prevented by controlling the infection in animals. This emphasises a one-health approach (humans, animals and environment) in managing the disease.

<https://infonet-biovision.org/AnimalHealth/Brucellosis>

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Diamondback moth

By Grace Kinyanjui



The diamondback moth (DBM) is a destructive pest of cruciferous vegetables, especially cabbages, kales, broccoli and cauliflower. The caterpillars feed by mining on underside of leaves resulting in irregular and translucent patches of damage.

The pupae are usually found wrapped in silky cocoon on leaves of cabbages and kales or in the florets of broccoli and cauliflower. Heavy feeding damages reduce crop yield, while the bare presence of mines, larvae, frass and pupae contaminate the vegetables, and reduce their quality and economic value.

Although synthetic pesticides will offer rapid control, they are short-lived, disrupt the natural ecosystem balance and result to more pest problems.

What can farmers do to properly manage DBM?

DBM exists as part of a large complex of pests attacking cruciferous vegetables. Hence farmers should adopt integrated pest management approaches to effectively manage them.

It is advisable to examine the plants carefully for any developing infestations and give special attention to the underside of leaves. It is also easier to hand pick and crush the caterpillars at the very early stages of infestations.

Pheromone traps that are specific for DBM can also be used to monitor their populations. These traps contain lures that attract and kill the male adults.

Generally, the number of trapped males indicates the abundance levels of the pest and the need for intervention. A Gemtrack lure for DBM can be purchased from Kenya Biologics Ltd.

Cultural methods of preventing and reducing DBM infestations include soil fertility management, polyculture farming, crop rotation and field sanitation.

Usually, healthy soils rich in organic matter produce healthy crops with vigour and strong resistance to pest attack. The soil organic matter can be increased via cover crops, green manure crops, organic mulch, animal manure and compost.

Other approaches include:

(i) Practicing polyculture

Polyculture farming of cruciferous vegetables may include intercropping or strip cropping. For instance, intercropping cabbage with crops such as tomato, onions, garlic, marigold, spider plant, pepper and beans reduces the populations of DBM.

This is a strategic companion planting that includes insect repellent plants to discourage infestation.

Planting a variety of crops in the farm creates an ecological balance of pests, natural enemies and other beneficial insects, which is healthy for crop growth as it discourages multiplication of one type of pest over others. Where natural enemies thrive, destructive pests will not dominate the farm.



(ii) Practice crop rotation

DBM only attacks the cruciferous vegetables. Thus, crop rotation with non-cruciferous crops will disrupt the pest's breeding cycle and reduce the population levels.

(iii) Adopt field sanitation

Another alternative is to adopt field sanitation practices such as control of weeds and wild plants that may serve as alternate hosts of DBM, removal and destruction of heavily infested leaves and burying of crop residues after harvesting.

(iv) Avoid synthetic pesticides

Practice biological control in your garden vegetable as using synthetic pesticides will kill natural enemies of DBM. The natural enemies of DBM include parasitic wasps, lacewings, hover flies, spiders, ladybug beetles, carabid beetles and birds.

They are mostly generalists and can therefore regulate the populations of DBM and other cruciferous pests provided the environment is conducive for their growth.

(v) Plant flowers around your farm

Diversifying crops and planting flowers in the farm will also attract a variety of these natural enemies which are highly beneficial in ridding your crops of the DBM and other destructive pests.

(vi) Use of biopesticides

Application of biopesticides is a last resort of managing high populations of DBM. Biopesticides based on *Bacillus thuringiensis* (Bt) and neem are highly effective against DBM and are commercially available. Homemade organic pesticides include extracts of neem, garlic, onions, chilli pepper, soap sprays and flour preparations. Crop spraying is better done early in the morning or late in the evening while targeting the underside of leaves.

In conclusion, there is no single bullet pest control approach to manage DBM. Although synthetic pesticides will offer rapid control, they are short-lived, disrupt the populations of natural enemies, impair the natural ecosystem balance and result to more pest problems.

Grace Kinyanjui is a plant pathology expert and a lecturer at Embu University.

<https://infonet-biovision.org/PlantHealth/Pests/Diamondback-moth-DBM>



Economic and health opportunities of strawberries

Vincent Kipyegon

Strawberries are a group of bright red juicy fruits that often grow in clusters that have delicious fleshy taste and nutritional benefits. They can be consumed raw and fresh, cooked or frozen. Its delicious taste makes it a useful additive to variety food products.

Strawberries are a good source of vitamin C, manganese, folate (vitamin B9), and potassium. They are used in adding flavour to meals, cakes and can be served as dessert and salad, making ice cream, strawberry juice and an additive of yoghurt.

There is a high demand for strawberries as a value addition product for other food products such as ice cream, yogurt and cakes. Additionally, strawberries require minimum attention during growth and take a short period to start producing fruits. This makes it a viable cash crop for the fast consumer market food.

Market forces demand the best size of a strawberry fruit. This is achieved by implementing the recommended farming practices. Most people grow strawberries together with flowers for aesthetic value. However, the plant can be turned into an income generating essential cash crop. Its demand in the market has overtaken the supply.

Health benefits of strawberries

1. Prevent heart diseases and lower high blood pressure since they contain high fibre and potassium content.
2. Strawberries contain powerful antioxidants such as carotenoids that guard against stomach, prostate, lung, breast, colon and pancreatic cancers.

3. They aid in weight-loss management due to low cholesterol content.
4. They boost immunity through excellent vitamin C content and antioxidants.
5. They are rich in vitamin C which is essential for the formation of collagen, a protein that keeps skin healthy.

Ecological conditions for growing strawberry

Strawberry grows well in deep fertile loamy sand soil with humus. They thrive in soil with pH between 5.5 and 6.5. The soil should be well drained and aerated to allow for growth of strong strawberry roots. Strawberries thrive well in temperatures between 20 and 37°C. Temperatures below 20 °C can lead to blight attack on strawberry leaves while high temperatures might scorch them.

Moderate annual rainfall between 1000mm and 1200mm is suitable for strawberry production. Irrigation is required where rainfall is below 1000mm to preserve the strawberry leaves. High rainfall can cause water logging on the roots thus weakening the plant and causing the fruits to rot.

Moderate sunshine is vital for the growth, development of strawberry plant leaves and ripening of fruits.



Ways of growing strawberry

1. Greenhouse

Advantages

- High yield; quantity and large size of fruits.
- Low exposure to pests and diseases.
- Minimum labour required on weeding.

Disadvantage

- Expensive to setup

2. Buckets, hanging, vertical gardens

Advantages

- Saves on space
- High yield of strawberry; quantity and medium size of fruits.
- Low exposure to pests and diseases.
- Minimum labour required on weeding and preparation.

Disadvantage

- Difficulty replenishing manure and soil to buckets and hanging structures.

3. Open field planting

Advantages

- High yields due to adequate nutrients on the soil.
- Maintenance is simple; mulching and replenishing of nutrients to the soil.

Disadvantages

- Labour intensive; preparation and weeding.
- The strawberry fruit sizes tend to be small.
- Prone to pests and diseases from the soil as well as rodents biting ripe strawberry fruits.
- Unpredictable weather patterns can lead to low yields.

Propagation of strawberries

Seedlings are obtained by propagating existing seedlings. Using a hand hoe, dig a section where the seedling grows or carefully pick small seedlings with a small vine from a strawberry nursery.

Land preparation and planting

Plough and re-plough the land at an interval of 7 days until it achieves a smooth surface without hard pans. The land is then left for a period of 3-4 weeks to solarize. This process exposes soil-borne pathogens to high solar temperatures. Afterwards, the land is then harrowed to a fine tilt.

Once the land is well prepared, the seedlings are planted directly to the soil at a depth of about 5 cm and 5 cm apart. The seedlings should be mulched to prevent moisture loss.

The farm should be irrigated on the planting day should it fail to rain. Irrigation must be carried out regularly during the growth period.

Fertilizers

Bio-fertilizers can be applied throughout plant growth stages. Tecamin by Agritecno is a pure organic liquid fertilizer with a variety purposes for rooting, healing, leaf development, flowering and fruiting.

Strawberries can be top-dressed continuously during their life-cycle to aid continuous absorption of nutrients.

Flowering

Strawberries develop flowers 80 days after planting. Any flower that develops before 3 months maturity period must be pruned. This gives the strawberry roots and runners a strong establishment. The flowers will undergo pollination and eventually develop small to medium sized fruits which will turn red to indicate that the berries are ripe and ready for harvest.

Weeding and pruning

Regular weeding is required to ensure the strawberry plant receives adequate nutrients. Ensuring the farm or buckets are weed free keeps the strawberry fruits and leaves healthy and pests and disease free.

Weeding is done by uprooting weeding by hand or using hand hoe to gently unearth weeds around strawberry plants. The plant's runners should be pruned in order for one strawberry plant to absorb necessary nutrients.

Pests and diseases

The pests include spider mites, broad mites and rodents that prey on over-ripe strawberry fruits. The diseases include blight, powdery mildew and rotting of fruits and leaves caused by heavy rainfall. Maintaining high hygiene and frequent monitoring around the farm is essential in eradicating pests and diseases.

Mulching with sawdust or dry grasses prevents moisture and keeps pests at bay. Ensure the fruits are not in direct contact with the soil. Create proper drainage around the plants on open fields during the rainy season to keep the plant less damp.

Harvesting and curing

Harvesting strawberry fruits starts as soon as they turn to red. Harvesting is a continuous process, strawberry plants develop flowers continuously hence have no harvesting periods. Over-ripe fruit attracts white flies and rodents that bite the fleshy fruit. Pick ripe berries by plucking vine near fruit. Spoiled and spotty fruits should be discarded.

Clean the fruits by rinsing with clean water. Pack the fruits into 100 mg food bags with ventilation holes then transport to market. Strawberries are highly perishable, so it is necessary to organize marketing plans ahead of harvest. They can be consumed directly or stored in a refrigerator for later use.

Economics of strawberry

Strawberries are highly productive for 3 years. On a 0.25 acre, 25000 kg, 1500 kg, 750 kg can be produced in the first, second and third year respectively. The price of 1kg of strawberries ranges between Ksh400 and Ksh600.

The size of a healthy strawberry fruit determines the entire farming strategy. The market demands medium to large sizes of strawberries. Given the farmer can address the size of the fruit during cultivation, strawberry farming is a lucrative agribusiness within all levels of the supply chain.

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“There is a high demand for strawberries as a value addition product for other food products such as yoghurt, ice cream and cakes.”



How to invest in mushroom farming

Mary Mutisya

With changing climatic conditions and food seasons, many farmers are going into smart farming to feed their families and earn a living. Some have turned to mushroom farming targeting high end markets where their demand is high. Mushrooms are some of the most nutritious foods, with at least 7 species being medicinal. Some health benefits of mushrooms are;

- *Mushrooms support brain health and cognition- Niacin and Copper found in mushrooms promote the function of the nervous system keeping the nerves healthy. Also, mushrooms contain vitamin B5, which is necessary for the production of various hormones that play an important role in proper brain functioning.*
- *Mushrooms support immunity- The anti-inflammatory effect of mushrooms has been shown to greatly improve the efficiency of the immune system.*
- *Mushrooms are great in the management of blood sugar- Mushrooms have low glycaemic index (the conversion rate of carbohydrates to sugars in the body) as they contain very low amount of carbohydrates, which means they do not raise blood sugar levels.*
- *Mushrooms lower blood pressure- Mushrooms are a rich source of potassium, a nutrient that reduces the negative impact that sodium can have on your body. Potassium also lessens the tension in blood vessels, potentially helping to lower blood pressure.*

A guide to mushroom farming

According to official statistics from the National Farmers Information Service (NAFIS), Kenya produces 500 tons of mushrooms per year against a demand of 1200 tones. This therefore means that there is a lucrative business opportunity for those interested to invest in the venture and below is a guide for farmers on how to grow mushrooms to tap on their nutritional benefits and earn an extra income.

Growing conditions

In Kenya, it has been proven that mushrooms can grow in almost all the parts of the country provided there is reliable water supply, shelter and stable temperature ranging from 15°C to 30°C.

How to get started and house construction

To grow mushrooms, you need land. Ideally a quarter an acre piece of land can be adequate to set up a mushroom facility that can give at least 4 tones of mushrooms after every 2 months.

After securing land, the next step is to construct a mud house, which is ideal for providing the ideal growth conditions. Wooden shelves are then placed in the house to utilize on vertical spacing.

This can be made with the help of a local carpenter and one can improvise using locally available materials to save on construction cost. During the construction, there is need to ensure that the house is well aerated for proper air circulation.

Substrate identification and nylon material assembling

After the mud house is ready, identification of the substrate/food on which the mushrooms will grow follows. The substrate can be forest soil, wheat straw, bean straw, millet straw or even rice straw. It is critical to make sure that the substrate is sterilized as the slightest bacterial infection can ruin the entire farm. A bale of wheat straw costs Ksh200 and one will need about 40 bales to start up a quarter of an acre of mushroom farm.

Once the substrate is ready, scouting for small nylon bags to prepare the seedlings and big ones for the final planting follows. For ¼ an acre venture, a farmer would need about 2,000 of the nylon bags.

Getting the seeds ready

The final stage in mushrooms farming start up is getting the seedlings (also known as spawns). The most popular (and easy to market) spawns are called button spawns and they can be bought from KALRO (Kenya Agricultural and Livestock Research Organization) or at the JKUAT (Jomo Kenyatta University of Agriculture and Technology).

A kilogram of button spawns costs around Ksh1,000 and 10 kilograms will be enough to get you started. Other varieties of mushrooms that are equally easy to grow include the shiitake and the oyster varieties. After growing the mushrooms, care should be taken until the mushrooms are mature, and this takes 1-2 months depending on the variety.



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Malindi	106.3
Location	Frequency
Webuye	95.9
Garissa	88.7

Location	Frequency
Taita	107.4
Narok	102.3
Nyeri	105.7
Machakos	93.8
Makueni	
Kitui	
Meru	105.1
Marsabit	88.3

Location	Frequency
Nakuru	104.5
Gilgil	
Kisii	91.3
Kisumu	105.3
Mombasa	105.1
Kericho	90.5
Eldoret	91.1

Tuko Mbele Pamoja!

Continued from Page 7

A guide to mushroom farming

Do's

- 1.) Always keep the growing environment/facility clean and sterile.
- 2.) Farmers are advised to experiment with a small farm before venturing into a big farm.
- 3.) Consult an agricultural extension officer in your area for further advice.
- 4.) Seek mentorship from farmers who are already doing this to understand what challenges they face.
- 5.) It's advisable for farmers to explore their market options in advance to avoid last minute surprises and disappointments.

Don'ts

- 1.) Farmers are advised to avoid taking shortcuts, mushrooms are very delicate crops and one can lose their entire investment if they don't follow professional advice in handling them.
- 2.) Farmers should avoid buying seeds (spawns) from cheaper sources. It is advisable that they always buy from reputable sellers e.g. JKUAT.
- 3.) Farmers should not forget that cleanliness is at the center of their farm's productivity.
- 4.) Don't be in a rush, take your time, like in any other business mushrooms take time to establish.
- 5.) Don't stop learning, keep researching and keep enquiring to learn the best practices.

How much to invest and returns to expect

To establish a mushroom farm in a quarter of an acre, one would need to invest about Ksh430,000. After construction of the facility, and establishment of the basic supplies, the cost of operating subsequent farming seasons will drop to about Ksh150, 000.

For button mushrooms, the entire growth period to harvesting is about 2 months (8weeks) and from 0.25 acre of land, with about 2,000 nylon bags one can harvest at least 4 tones of mushrooms. A Kilogram of mushroom goes for an average price of Ksh600 and this can translate to as much as Ksh2.4 Million in sales revenue.

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<https://infonet-biovision.org/PlantHealth/Crops/Mushrooms>

FARMERS' FORUM

Would you like to buy pumpkins in bulk? Samuel Waweru from Murang'a is selling the best varieties.

Roseline Alkahi from Bungoma is selling quality cassava at an affordable price.

William Masea from Migori is selling Hass & Fuer te avocado varieties at farm gate prices.

Levis Munyasya from Trans Nzoia is selling avocado seeds.

To get their contacts, call: 0715 422 460



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