



MAURITIAN WILDLIFE FOUNDATION

Protection of Fruits from Birds and Bats

Background: Mauritius Fruit Bat

Fruit bats arrived in Mauritius a very long time ago, so long ago that they have had the time to become a different species which is now unique to Mauritius, the Mauritius Fruit Bat. This bat has adapted to eat fruits of endemic and native plants, and pollinates their flowers and disperses their fruits or seeds. Previously, Mauritius was covered with dense and luxuriant forests which provided trees on which bats could feed.

When humans arrived on the island over four hundred years ago, they began cutting down the forests for agriculture and other developments. Man also brought to the island all kinds of plants and animals, many of which have become invasive and have had a devastating impact on the original animals and plants. We are now left with less than 1.5% of good quality original forest.

The Mauritius Fruit Bats have managed to adapt to modified habitats to survive, and when food is short in the forest they look for other food sources such as introduced fruit, which has led over the years to a conflict with backyard and orchard lychee and mango growers.

The number of bats in Mauritius has not been reliably assessed and this was one of the several reasons why the Mauritian Wildlife Foundation opposed the cull in 2015. The cull and the illegal hunting may have reduced the population drastically and put the bat population in a very precarious position, making it highly vulnerable to extinction should there be a strong cyclone. There was a second, more limited cull in 2016, which MWF has also opposed. On the positive side, there was a concerted effort to improve bat counts.

Protection of Fruit Trees

The Mauritian Wildlife Foundation (MWF), whose mission is to protect threatened endemic species like the Mauritius Fruit Bats, wishes to engage in a dialogue with fruit growers, to look into why, how and when to protect their fruit trees from birds and bats by the use of netting, and the advantages of pruning trees. MWF also wishes to hear from farmers about ways to reduce damage to fruits, without resorting to culling. The Mauritian government introduced a cull (killing) of bats in 2015, however, **culling has been proved not to work as a fruit protection measure** in other countries, like Australia. **Netting is considered to be the only efficient solution to prevent fruit damage.** It is used, along with pruning to keep trees small. To support that, the cull on Mauritius in 2015 is reported to have caused a drop in damage of 10% (official government figure), clearly showing that culling is not the solution. On the other hand, **efficient** netting can completely eliminate damage by bats and birds. In August 2017, we organised a 'Netting Workshop' in collaboration with the Ministry of Agro-Industry and Food Security, Chester Zoo (UK) and the IUCN. This workshop was attended by fruit farmers and received technical advice of farmers and researchers from Australia and Thailand.

Recommendations have been provided for pruning of trees, netting, equipment and subsidies in a multi-stakeholder workshop held in August 2017-([Download Pdf](#)). We are working with all stakeholders to find practical non-lethal solutions to address the human-fruit bat conflict.

Subsidies for Nets

The Government of Mauritius, through the Food and Agriculture Research and Extension Institute (FAREI) of the Ministry of Agro-Industry and Food Security, subsidises 75% of the cost of nets to help fruit growers reduce damage to their fruit trees. The Fruit Protection Scheme developed by the Government of Mauritius deserves to be praised and improved. The scheme has undergone regular improvements over the years. In 2017, the scheme provides the 75% subsidy on the cost of nets for backyard farmers to net up to five trees in total. Orchard owners also benefit from the subsidy to cover half the number of trees growing in orchards that are less than 2 acres in size. Requests for the subsidy are considered only if the applicant was not a beneficiary in the past two years.

Please contact FAREI on 433 4378/433 9350 for more details.

Netting of fruit trees: General guidelines

- **Timing:** It is important to net your tree before your fruits reach mature green stage, which is, when flowering has finished and fruits are developing but are still small compared to their size when fully developed. Fruits can be considered immature when they have just started to develop and have not yet reached around 2 cms for lychees and more than 5 cms for mangoes, and have not yet produced the fleshy parts of the fruit (a size where animals usually cannot feed on them).
- **Colour of net:** If possible, use white netting to prevent bats from getting entangled in them since black nets are less visible to bats at night.
- **Width size of net:** Chose the width of your net according to the size of your tree (See 'How to net a tree'),
- **Mesh size:** Chose a net with mesh size such that a human finger does not pass through since bats are less likely to get trapped in such nets.
- **Lifting the net:** It is important to place a distance between the surface of the tree canopy and the net so that bats and birds landing on the net will not be able to eat the fruit through the net (see 'How to net a tree').
- **Seal the tree:** The net should cover the entire tree and also be sealed to ensure birds or bats cannot go under the net. (see 'How to net a tree'). It is extremely important to close holes in the net. Holes would enable bats and birds to enter through the net but then get trapped under the tree as they cannot find the exit. In the meantime, the entrapped animals will eat more fruits since they will only be able to escape with difficulty from inside the net.

How to net a tree:

NETS MUST BE LIFTED OFF THE CANOPY AND SEALED AT THE BASE FOR EFFECTIVENESS

1. Materials needed: Net of appropriate size (one that will cover the whole tree), at least 2 long poles with forks at the ends, short metal or wooden rods that will distance the net from the tree, duct tape, raffia or nylon rope and eventually rocks or, pegs to pin down the net to the ground, and plastic bottles to prevent poles from tearing holes in the net.
2. You will also need a minimum of 3 people to net a tree (up to 5 people for a large tree).
3. Calculation of net size:

Since we are approximating the tree canopy surface to that of a circle, the width and length of netting will be the same.

Please also note that your options of width of netting may be limited by the availability of these netting sizes on the market in Mauritius.

To calculate the amount of netting needed:

$(\text{Height of tree} + 50 \text{ cm}) \times 2 + \text{width of tree} + 50 \text{ cm} (\times 2) = \text{length of netting.}$

As an example, for a 6 m high tree, and a tree with a canopy which is 4 m wide:

$(\text{Height (6 m)} + 50 \text{ cms}) \times 2 = 13 \text{ m} + \text{Width (4 m)} + 50 \text{ cm} (\times 2) = 18.0 \text{ m}$

Width needed = 18.0 m

Length needed = 18.0 m

4. Installation of the net:
 - a) Roll half the net from one side and half from the other side so that both rolls meet in the centre of the net.
 - b) Attach a knot around both ends of the rolled net with a string.
 - c) One person can climb to the highest point where they can on the tree. Next, you will need to place the rolled net on the top central part of the tree canopy. You can do this using a variety of different techniques, amongst which are examples below:

Method number 1

- a) Attach one piece of strong nylon thread to both ends of the rolled net.
- b) 1 person holding each end of the net by the extremity can throw the rope up and pull the net to the highest point on the tree.
- c) The person on the tree can then make sure that the net is on the central part of the tree, and if not, move the net with a rod to put it on the top central part of the tree canopy with the 2 ends of the still rolled net falling on to the bottom of the tree canopy.

Method number 2:

- a) Place each end of the rolled net on rods with forks at their end. 2 persons should simultaneously move each end of the net up the tree to its highest point (on the top central part of the tree canopy).
- b) Then untie the ropes which were holding the net rolled to allow the net to unroll and thus cover the whole tree canopy.
- c) The person(s) on the tree can then stick wooden/metal/PVC rods on the top of the highest tree branches they can reach throughout the tree and attach them firmly to those tree branches using duct tape (strong packing tape) or ropes (raffia, coconut),

thus leaving a sufficient space of approximately 50 cms between the net and the tree canopy.

- d) Fixing upturned cut plastic bottles to the end of the rods which holds the net can help to stabilise the net and to protect it from everyday wear and tear.
- e) You can also use a few long poles which start off the ground and that are a minimum of 50 cms longer than the tree's highest point to reach the same result.



Partially netted tree: A white net has been used and lifted off the tree canopy with poles. The net has not been sealed.

- 5. Seal the ends of the net around the tree trunk with strong ropes or seal firmly to the ground with some heavy objects (such as heavy rocks, bricks etc) all around the tree to keep the netting tensioned over the poles and stop animals from getting under the net. Tie wire can also be used to stop the net slipping and sagging on the rods/poles. The more places that the netting is held in position, the more even the tension of the netting will be on the rods/poles. This tension will prevent bats or birds that land on the net from collapsing into the net and eating the fruits or damaging the netting, and will reduce the risk of bats getting entangled in the net.



The net excludes birds because it is resting on the ground.

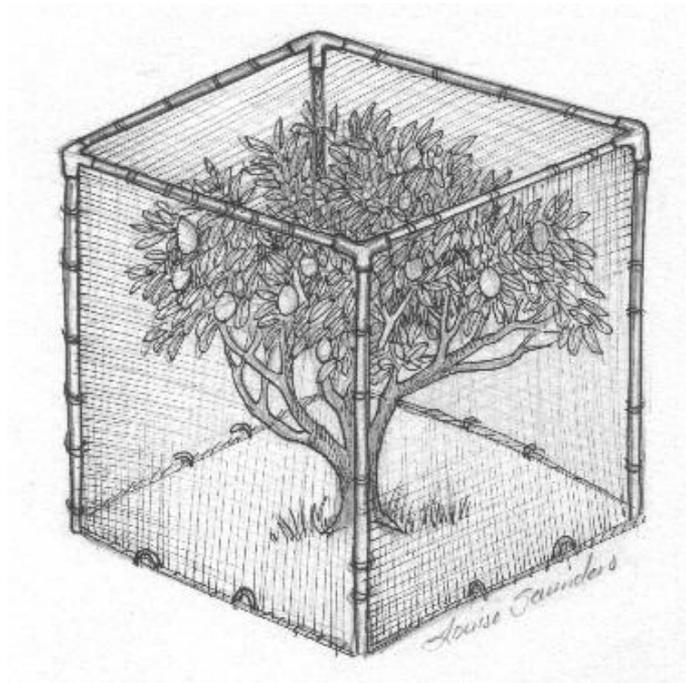
6. For the netting to be effective, it must be tensioned enough to stop folds of net forming around an animal when it lands on or crawls over the net. Ideally, a bat should almost bounce off the netting rather than sink into it when it lands. Check netting at least every day for animals that could become entangled in the net or for repairs if holes have been found.

The methods to net a tree properly are highly dependent on the tree's height and shape, number of people, available materials and your budget amongst other factors.

(Note: MWF would be glad to hear about other methods you have used to net your tree. This will help us to improve our own netting techniques and communicate those to fruit growers.)

Fixed frame netting

You can also use fixed frames to hold the netting on your tree in place. This type of netting would be more durable, and will also protect your net better from all wear and tear and allow it to be used for longer. A framing system is relatively costly and is usually adopted by commercial fruit growers but can be used by backyard growers too. However, it can be put up cheaply and easily on dwarf trees.



Netting on a (semi)-permanent frame made from PVC pipes or galvanized metal pipes is ideal for trees that are short or pruned.

Source: https://www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/netting_fruit_trees.html



Fixed frame netting in Australia for apples (courtesy Greg Richards)



Fixed frame netting in Thailand for longan (courtesy Sarah bumrungsri)

(See: <http://www.wildlifefriendlyfencing.com/WFF/Netting.html>)

Where to buy a net?

Company Name	Address	Telephone
Quincaillerie A1	Club Road, Vacoas	686 1111
Bricomax Ltd	Centre Commerciale Emerald Park, Trianon	454 5315
Universal Development Corporation (PTY) Ltd - UDC	34, Epingles Street, Mont Roches, Beau Bassin	466 0888
Kirsh Co Ld	BS House, Royal Road, La Marie	684 0102
Greimex Ltd	3, Mere Teresa Street, Port Louis	5292 4620
SOFIDIS	7, Dr Raoul Felix Street, Rose Hill	454 2317
Quincaillerie Ah Kee	Cnr John Kennedy & St Paul Road, Vacoas	6863340

(Note: If any other company who sells nets is not listed above and would like to be, please get in touch with MWF and we will update our website).

Removal of nets (not on frames) after fruiting

It is preferable to remove nets once the fruiting season is over to prevent the netting from being damaged by the growth of the tree or to facilitate pruning of the tree.

The life of the net is increased if used only during the fruiting season, removed from the tree, (washed if affected by salt spray), dried with debris removed, folded and stored in a rodent proof place or in a rodent proof container (e.g. a plastic barrel) during the non-fruiting season.

Financial benefits from a net

By placing nets on fruit trees, the trees will produce more fruit and thus provide more revenue (if the fruit is sold) or more benefit (if the tree is in a backyard and the fruit eaten by the family). If UV protected nets are purchased they could last 10 years. The cost of the net, materials and installation cost is compensated for by the additional fruit gained. An excess of fruit can also be frozen for future consumption or made into juice.

(Note: Please let us know if you have any other ideas of how you can use excess lychees or mangos. If relevant, a recipe or instructions would be welcome. We will publish it on the website).

“Pick your own”

You can also make profits from the surplus of fruits you will get from placing a net properly on your tree, by inviting your neighbours, family and friends, for example, or just anyone else, to pick fruits by themselves from your trees. You may choose to request payment for the number of fruits they have picked. Thus both of you will benefit from it.

Protection from Rats

Rats can also climb your lychee tree and eat your fruits. Solutions include:

- Trapping rats using rat ‘glue’ available from hardware shops and supermarkets on wooden board
- Snap traps and rodenticides
- Grease around the trunk of trees and trimming branches that touch the ground to make it difficult for rats to climb trees

Giving proper care to your trees

Spray against fungal disease.

We recommend fruit growers to spray their trees against fungal diseases, to decrease the amount of damage caused to fruit crops every year.

Pruning trees.

Keeping trees below 6 m high has several advantages. Some farmers in Australia prune trees to shoulder height. The tree is much easier to net, spray and harvest. It also allows trees to be grown at higher densities. Even if the pruned tree is not netted, bats are much less likely to land on the tree. However birds will still cause quite a lot of damage to the fruits.

Trees can also be pruned gradually over several years rather than being drastically pruned to buffer against the sharp loss in fruit production.

FAREI have produced a useful guide to pruning a lychee tree. The document is available on the MWF website and [click here to download](#).

General

Experience in Australia has shown a doubling of fruit yield when pruning, netting, more efficient spraying and higher planting densities are combined. For full report, see <https://rirdc.infoservices.com.au/items/00-029> (Lychee, Longan and Rambutan: Optimising canopy management).

In Thailand, fruit pickers are reluctant to climb tall trees, and have driven pruning of trees to more reasonable heights (<5 m).

Things to know about your fruit trees

Did you know that:

- a) The majority of mango and lychees flowers or fruits are naturally lost before they reach mature green stage?
- b) Some sources estimate that fruits (up to 70% of mangoes) are not harvested due to difficulty in picking fruits from tall trees and also as a deliberate policy to keep prices inflated.
- c) Other factors combined (excluding bats), can cause as much or more damage to fruit trees than bats.
- d) Keeping your trees low (below 6 m) helps to significantly reduce the impact of bats on your tree? Bats hate landing on low trees, as it is harder to fly off again.
- e) Fungal diseases also attack your fruits, giving them a black colouration and causing the fruits to split open, and can cause a high proportion of damage to your fruit trees? This is why spraying against fungal diseases will considerably increase the amount of fruits you will get from your tree.
- f) Other factors such as the wind cause a lot of natural fall and thus fruit loss to your tree. Placing nets on your trees can help to slightly decrease the damage done by the wind by forming a barrier to the wind. Nets also provide a better microclimate for a fruit tree to grow in and for fruits to develop.
- g) Mangoes, being a climacteric fruit can be harvested at mature green stage and will continue to ripen. Lychees do not ripen further after picking.
- h) Alternate bearing fruit trees (those that tend to produce a lot of fruit one year and little fruit the next) will fruit better and produce more evenly if watered and fertilised in between fruiting seasons.
- i) Whilst dwarf mango varieties exist, such is not the case for lychees. Lychee trees thus need to be pruned annually to maintain them short.

Acknowledgements

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Note: *The Mauritian Wildlife Foundation has made every effort to ensure that the information given above is accurate but welcomes comments and suggestions from the reader to improve or clarify the content. We are also looking into the effectiveness of other means of fruit protection. Please email: executive@mauritian-wildlife.org or write to: The Project Officer, Bat Project, Mauritian Wildlife Foundation, Grannum Road, Vacoas.*

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