

Canopytechtur – A Novel Structure for Growing Creeping Horticultural Crops in Limited Space

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Abstract: The concept of urban horticulture has lately been addressed by the government, especially through the Ministry of Agriculture and Agro-based Industry of Malaysia. Urban agriculture can reduce kitchen expenditure, increase food and nutrition securities and economy of urban poor. In line with the concept of urban agriculture MARDI introduces canopytechtur, an innovative technique for growing creeping or climbing vegetables. Canopytechtur is a novel structure designed to support the growth of climbing vegetables or fruits. Moreover, it is specifically designed for urban settings that are usually limiting in space as well as for urban dwellers who are interested to practice farming in the cities. The canopytechtur is a hexagonal frame with a diameter of 150 cm and is located on top of a supporting pole 180 cm in length. Climbing vegetables or fruits grow vertically towards the hexagonal structure. In the early stages of growth, plants need to be constantly trained and coaxed to the raffia rope attached to the canopytechtur. Creeping vegetables such as luffa, bitter gourd, cucumber and pumpkin can be grown using canopytechtur. Irrigation and fertilization are provided to the plants for sufficient plant and fruit growth. Studies have shown that plants grown using this structure are healthier, more attractive and can be easily harvested. Luffa, bitter gourd, cucumber and pumpkin can be harvested at 50-140 days after planting by picking the fruits hanging from the canopytechtur. Not only canopytechtur enables and enhances the production of plants in compact spaces, it can also provide aesthetic and therapeutic value to the space itself.

Keywords: Canopytechtur structure, Self-watering container (SWC), creeping vegetables

INTRODUCTION

Contrary to standard practices, vegetables and fruits can actually be grown in limited spaces such as in apartment and office buildings as well as neighborhood parks. However, planting creeping vegetables and fruits in these compact areas requires a supportive structure to allow the plants to cling, grow vertically and produce yield. Conventionally, a trellis made of wire and bamboo sticks are often used as support to allow for fruiting vegetables to climb and grow. Current trends in urban agriculture include developing production systems that are simple, practical and modern-looking. Thus, a novel structure was designed to meet these features associated with urban lifestyle. This multi-

purpose structure is called canopytechtur. The main function of canopytechtur is to support the growth of climbing vegetables or fruits. In addition, the unique canopy design allows for fruit hanging thus making fruits easier to harvest (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). The shaded area created underneath the canopy can be transformed into a garden lounge by placing a garden chair beneath the canopytechtur therefore adding aesthetic and therapeutic value to the area where the canopytechtur is present (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019).

FEATURES OF CANOPYTECHTURE

Canopytechtur is a multi-purpose support system for the cultivation of climbing vegetables and fruits. It is designed to allow the plants to twist, cling and grow vertically. This structure has a special hexagonal canopy which is 150 cm in diameter and is located on top of a supporting pole with a height of 180 cm. (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). Through training and bending process, creeping vegetables or fruits can grow vertically and produce fruits that hang throughout the width of the canopy. Another special feature of canopytechtur is that it can also be applied to a self-watering container (SWC) or other regular planting pots (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). Canopytechtur is suitable for climbing vegetables such as luffa, bitter gourd, cucumber and pumpkin as well as creeping fruits such as grape and melon (Hamdan, 2016 and Hamdan *et al.*, 2017). This novel design may encourage more urban farmers to cultivate even with limited garden spaces. Besides producing fruits, canopytechtur can also provide an aesthetic impact and become a therapeutic element (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019) to the area.

CULTIVATION

Seedling preparation

Vegetable or fruit seedlings is prepared by sowing seeds in a nursery tray containing multiple cells. Peat moss is the recommended seed germination medium. The tray is placed in an area with 50% sunlight. Seeds should be watered twice daily using a smooth or capillary sprayer (Blizzard and Boyer, 1980; Nalliah and Ranjan, 2010; Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). Seeds will usually germinate

within 3-4 days and the seedlings are allowed to grow. Foliar fertilizers can be sprayed to produce healthy and quality seedlings. Once the seedlings produce 2-4 real leaves, they can be transferred into the canopytechture pot. The process of transferring seedlings should be made in the morning or late evening to prevent heat shock.

Planting pots

Generally, 2-weeks old seedlings should be transferred into a container or pot. The number of seedlings to be planted depends on the size and type of the selected pot. For a self-watering container (SWC) which is equipped with a water reservoir system (size 52 cm x 46 cm), as many as four seedlings can be planted. Using SWC, plants do not need watering often because water is provided by the reservoir through capillary action (Blizzard and Boyer, 1980; Nalliah and Ranjan, 2010; Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). The most suitable planting medium is a mixture of soil, peat moss, sand and processed oil palm shells at a ratio of 1:1:1:1 (Jury and Horton, 2004; Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). Dead seedlings should be replaced immediately to obtain uniform growth and yield.

Training plants

After 2-3 weeks, seedlings will reach a height of 15-20 cm. Plants are then supported by using raffia ropes for them to grow vertically (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). The raffia rope is tied to the U-shaped bent wire (10-15 cm high) which is punched adjacent to the base of each plant (Plate 1). The other end of the rope is drawn to the canopytechture about 1.5-2.0 m above the medium surface level (Plate 2). During growth, plants are trained to climb and swing around the raffia rope and grow perfectly vertical towards the hexagonal canopy (Plate 3).



Plate 1. Raffia tiers tied at crooked wire shaped U and pierced beside the base tree



Plate 2. The end of the raffia rope pulled and tied to parts the typical canopytechture



Plate 3. Plants need trained to climb, wrapped in raffia rope and grew vertical to typical structures

PLANT TYPE AND GROWTH

When trained since the early stages of growth, creeping plants will grow well vertically using the canopytechture (Plate 4). Plants will begin to produce flowers and bear fruits after 3-4 weeks of planting (Plate 5). The estimated time for harvesting depends on the type of vegetables or fruits (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). For example, luffa and bitter gourd can be harvested within 7-16 weeks after planting (Plate 6). Table 1 shows the duration of fruit production, yield and life span of different vegetables grown on canopytechture using SWC.



Plate 4. *Plants grow vertically need to be trained in the early stages of growth*



Plate 5. *Vegetables begin to bear fruit after 4 weeks of planting*



Plate 6. Pumpkin removing fruit and can harvested within 7 - 16 weeks after planting

Table 1 shows the duration of fruit production, yield and life span of different vegetables grown on canopytechure using SWC.

Plant varieties	Harvesting (day)*	Number of fruit/structure	Fruit weight (g)	Total yield/structure (kg)**	Plant shelf life (day)
Vegetables					
Luffa	50 - 79	28	300 - 500	11.2	79
Bitter gourd	51 - 98	24	300 - 400	8.4	98
Cucumber	55 - 70	18	400 - 650	9.5	70
Pumpkin	77 - 140	5	700 - 900	3.9	140
Fruits					
Melon					
(variety Hang Lipo)	76 - 85	8	600 - 1100	6.8	85
(variety Permai 5)	76 - 86	8	900 - 1600	10	86

* Day after transplanting

** Refer to four plants per container

PLANT MAINTENANCE

Irrigation

For plants cultivated using canopytechure with the application of SWC, irrigation is done periodically. The frequency of adding water in the SWC (size 52 cm x 46 cm) reservoir depends on the age and type of plants (Blizzard and Boyer, 1980; Jury and Horton, 2004; Mahamud, *et al.*, 2009; Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). In the early stages of growth, plants need minimal irrigation where water is added 7 days after the first addition of water. As the plant grows, water is added more frequently. For example, cucumber and luffa plants requires water to be added every 2 to 3 days (about 5 liters of water per

addition) when the plants are fruiting. Meanwhile, for plants cultivated using canopytechure applied on the ground or other standard pots, plants should be watered twice a day i.e.: early morning and late afternoon except for during rainy days.

Fertilization

Climbing vegetables or fruits grown in pots need to be fertilized to ensure a healthy and fertile growth. Fertilization can be done manually using compound fertilizer NPK 12:12:17:2 at 10 g/plant (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). Fertilizer is given every 3 weeks by distributing around the base of the plant or by mixing it into the medium. However, if there are symptoms of nutrient deficiencies such

yellowish of leaves and unhealthy growth, foliar fertilizers can be additionally sprayed. Nevertheless, excessive fertilization should be avoided as it may cause the plants to overgrow or better known as becoming 'excessive vegetative growth' (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019).

Pruning

Pruning of wild or unwanted shoots is done to obtain uniform and attractive plants. It is done concurrently during the training of plants to grow vertically towards the hexagonal canopy (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019). In addition, pruning can also prevent plants from wasting fertilizer usage.

MANAGEMENT OF PESTS AND DISEASES

Creeping vegetables and fruits may often suffer damages due to pest and disease infestation. Therefore, integrated pest and disease management by using the proper type and application rate of pesticides will increase the success of control measures. Notwithstanding, the cleanliness of the surrounding environment where the plants are grown must be kept to its optimal. Frequent observations of early symptoms of pests and diseases must be done where preventive actions can be taken immediately (Hamdan, 2016; Hamdan *et al.*, 2017; Hamdan *et al.*, 2019).

CONCLUSION

Canopytechure is specifically designed to maximize the use of compact spaces for the cultivation of climbing vegetables and fruits. Plants are produced on the canopytechure through seed sowing and planting in self-watering containers, regular planting pots or on the ground. In the early stages of growth, plants need to be constantly trained and coaxed to the raffia rope attached to the hexagonal canopytechure. Proper irrigation, fertilization as well as pest and disease control measures are applied for optimal plant growth. Besides as a food source, hanging fruits from the

canopytechure adds aesthetic and therapeutic value to compact spaces.

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