

Innovative floating garden design to support food security in rural Bangladesh

Angelos Deltsidis, Mohd. Rezaul Islam, Amrita Mukherjee, Elizabeth Mitcham, Michael Reid
www.horticulture.ucdavis.edu - Presenter's e-mail: adeltsidis@ucdavis.edu
 Horticulture Innovation Lab, University of California, Davis, CA, USA

Abstract

Wetland agriculture on various types of floating gardens has been used for centuries in many countries. Bangladesh is a low-lying country that suffers from seasonal floods during the rainy season that render land unsuitable for growing fruits and vegetables for extended periods of time. Widespread small-scale fish farming and large freshwater lakes in rural areas also significantly reduce the land available for cultivation. We have designed an innovative floating garden constructed from locally-available materials that allows small-scale fish farmers to grow horticultural crops on their ponds. The garden comprises a bamboo 'raft' containing a soil-less medium of coconut coir and vermicompost. Flotation is provided by empty second-hand plastic containers attached to the bottom of the raft. A rope and pulley is used to move the floating garden from the bank (where it can be tended) to a sunny location of the pond. In-situ solarization of the growing medium is used to pasteurize the medium. Pest-exclusion nets and Neem extracts can be used to reduce insect infestations. A range of horticultural crops have been successfully grown on the gardens, and we are presently monitoring the impact of the gardens on family nutrition and income of rural families. The gardens also provide a location for producing seedlings that can be transplanted into ground beds when the floodwater recedes. This allows farmers to obtain higher prices due to the early-season production. We are continuing to determine the horticultural and financial constraints of crop production in these novel gardens.



Introduction

- Smallholder fish farmers in Bangladesh often do not have enough sunny space since properties are filled with the pond.
- House and the borders of the pond are often heavily shaded by large trees.
- Garden based on traditional floating gardens which are using deep piles of water hyacinth on top of the water - not suited to use in smallholder fish ponds due to the decomposition of the water hyacinth which removes oxygen from the water.
- UC Davis Floating garden provides a space for such farmers to produce nutritious vegetables and other high value crops on their ponds.
- The UC Davis Floating Garden uses a soil-less, lightweight medium that does not affect the pond water or fish.

Materials and Methods

The UC Davis Floating Garden is composed of:

- A bamboo raft
- A bamboo-made fence around over the bamboo raft
- A plastic mesh lining the garden
- Growing medium
- Empty plastic containers beneath the raft to support the garden

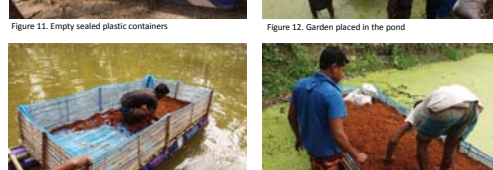
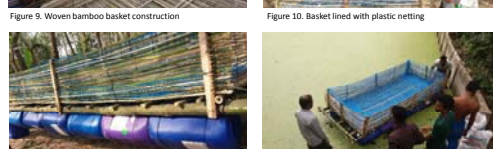
Floating garden construction costs		
Item	BDT	USD
Bamboo	1500	19.3
Bamboo Fence	500	6.4
Vermicompost	500	6.4
Coconut coir	800	10.3
Net	200	2.6
Rope and Nail	200	2.6
Container	1500	19.3
Labor	2000	25.7
Total (w/ labor)	7200	\$92.6
Total (w/o labor)	5200	\$66.9

Table 1. Floating garden construction costs



Building the floating garden

- The floating garden is filled evenly with soilless growing medium.
- A typical growing medium contains 80% coconut coir dust and 20% vermicompost.
- The growing medium should be at least 30 cm deep.
- Vermicompost or other well composted material provides necessary nutrients for the plants.
- The medium is initially wetted by sprinkling water from above.
- Seeds or plant seedlings of the desired vegetables are planted in the garden.



Placement of the floating garden

- The garden can be positioned in full sunlight.
- Rope and pulley system allows farmer to work on it from the bank, then return it to a sunny area of the pond.

Plant care

- Plants in the garden grow quickly, and respond to normal horticultural practices.
- Seedlings are thinned after the first true leaves emerge to avoid over-crowding.
- Stakes or trellises are used as appropriate for taller plants.

Plant nutrition

- Vermicompost provides nutrients for the plants
- Side dressings of well-rotted cow or chicken manure can be used if plants are showing signs of nutrient deficiency
- Vermicompost can be added into the medium in between crops to maintain the soil level and add nutrients for the next crop.



Pest management

- Insect pests or bird damage can be prevented using protective nets.
- To prevent insect infestation, gardens can be covered with white woven exclusion nets.
- The nets are installed after planting using support structures to maintain the net high enough to avoid contact with the growing plants.
- Weights attached to the edges of the net can be used to submerge the net edges below the water to prevent entry of insects.

Solarization

- Environmentally friendly method of controlling pests (some soil borne pathogens along with weed seeds and seedlings) without the use of chemicals.
- A sheet of clear sheet of plastic is placed on the prepared growing medium.
- The garden is moved to a sunny location in the pond and left for 2-3 days or longer.
- Temperature of the medium becomes high enough to kill weed seeds, pests, and some fungi.



Discussion

- The floating garden prototype has successfully been tested in small-holder fish ponds.
- Experiments under way at Patuakhali Science and Technology University are testing a range of media components that might reduce weight of the garden, thereby reducing the number of floats required to support it.
- No adverse effects to the water quality of the fish ponds have been found. Farmers can continue their usual fish culture practices.
- The gardens support early production of high value crops, achieving higher incomes. Farmers are producing seedlings towards the end of the rainy season which are transplanted to the ground once it dries out.
- The effects of having a garden to provide fresh vegetables on family income and nutrition is being studied. Thirty six families in three communities have been provided with gardens, and they will be compared with similar families in control communities.

Conclusions

Advantages of floating gardens

- Garden is sized so that it can be tended from outside.
- Planting can be dense since spacing only needs enough to accommodate plant growth and access to sunlight.
- No watering is required.
- The plants are protected from household and other animals.
- The gardens are productive even during the rainy season when the soil of traditional gardens is waterlogged.

Success story

- Mr. Babul Bepari, smallholder farmer from SujonKathi village in Barisal region.
- Household of three including his young son aged 14.
- Harvested 13 kg of vegetables during the past summer season (chinese spinach, indian spinach, cucumber, gourds, and mint).
- Garden products are consumed by the household, contributing to family nutrition.
- One floating garden supplies the family with pesticide-free vegetables throughout the year, even during the rainy season.
- Daily household expenses for vegetables have been reduced; expenditure is now mainly on rice.



Acknowledgement

This presentation is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of the Horticulture Innovation Lab Bangladesh Aquaculture-Horticulture for Nutrition Collaborative Research Program and do not necessarily reflect the views of USAID or the United States Government.