Wicking Bed: A Water Saving Technique for Urban Households

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Water is the lifeblood of ecosystems, including forests, lakes and wetlands, on which the food and nutritional security of future generation depends. Water has become the scarcest commodity in the world due to the ever-increasing demand and over exploitation. All over the world, during next two decades, usage of water will increase by 25 per cent, resulting in doubling the scarcity (Prakash *et al*., 2017). Due to population growth, urbanization, and climate change, competition for water resources is expected to increase, with a particular impact on agriculture. Population is expected to increase to over 10 billion by 2050, and whether urban or rural, this population will need food and fiber to meet their basic needs. Combined with the increased consumption of calories and more complex foods, which accompanies income growth in the developing world, it is estimated that agricultural production will need to expand by approximately 70 per cent by 2050.

Irrigation is essential for the successful of agriculture particularly in the area, where rainfall is inadequate, uncertain, and unpredictable. Irrigation is the major consumer of groundwater in the world. Agricultural sector alone consumes 80 per cent of the ground water (Harsha, 2017).

Urbanization share of India in 1951 was 17.29 per cent which became 31.16 per cent by 2011 (GOI, 2020). According to the reports of FAO, by 2030, 60 per cent of the people in developing countries will likely live in cities. This rapid growth of city population in the developing world is placing enormous demands on urban food supply systems leading to food shortages during the time of crisis (Bhat and Paschapur, 2020). Urban agriculture could be the saviour to avoid food crisis and inflation of market. Growing food in cities for human consumption could be one means of increasing global food supply in the face of rising population growth and global food security concerns (Mc Dougall *et al*., 2019).

Wicking bed

A wicking bed (WB) is a plant driven system where plants receive water through capillary rise from a self-contained coarse material filled subsoil reservoir (Semananda *et al*., 2018). The wicking bed system is a way of growing plants in which water wicks up from an underground water reservoir. The major advantage is significant increase in production while water use has been shown to be reduced by up to 50 per cent of conventional practice. Significant quantities of water are stored in the reservoir resulting in less frequent water applications. A wicking bed is an agricultural irrigation system used in arid countries where water is scarce. It was devised by Australian inventor Colin Austin. This system is designed to increase food production while using around half the amount of water that a more traditional irrigation system would use. It can be used both in (arid) fields as well as in containers. Besides use in fields/containers outdoors, it can also be used indoors (i.e. greenhouse). It has been identified as a simple, potentially water and labour efficient irrigation method compared to hand irrigation. The system is designed to increase food production while using approximately 50 per cent less water than traditional irrigation, by utilizing underground water reservoirs filled with decomposing organic matter and the process of evaporation.

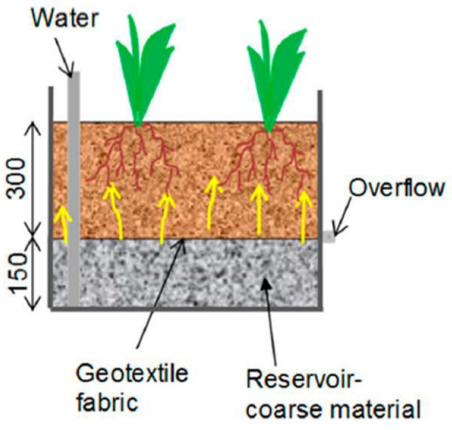

Fig. 1. Systematic diagram of a wicking bed

The main source of water for plants in wicking bed is the capillary water that rises from the reservoir. Capillary rise is a natural process, and as such wicking

beds are inherently a low-tech system. Water is one of the main factors in producing a healthy crop and yield. Water is usually retained in the soil, and plants uptake water from the soil. Water near the soil surface is evaporated more easily than water further beneath the soil surface. So, the plants growing in the wicking bed system would use water more efficiently than surface irrigated pots (Semananda *et al*., 2019).

Important parts of wicking bed

The important parts of a wicking bed are an underground reservoir of water and growing medium, inlet pipe for watering, overflow drain pipe and a geotextile or shade net.

Underground reservoir

The water reservoir is typically filled with coarse organic material or aggregate. If stones or gravel are used for filling, it should be smaller ones. Bigger stones have a larger surface area, and the wicking action will be reduced.

Geotextile fabric or shade net

Fig. 2. Geotextile

It is placed between the reservoir and the growing medium to avoid the mixing of soil with reservoir to avoid the clogging of the gaps.

Growing medium

Growing medium is filled with good potting mixture of soil, coir pith compost and FYM for the growth of plants.

Inlet pipes and overflow drain

Inlets pipes are used to give water directly to the reservoir. It should be covered with lid to prevent mosquitoes or dirt getting into it. Overflow drain is placed between the reservoir and the growing medium. This prevents overwatering, allowing surplus water to seep out rather than waterlogging the topsoil which will cause damage to soil.

Benefits of wicking bed

The main advantage of wicking bed is significant increase in production while water use has been shown to be reduced by up to 50 per cent of conventional practice. This system has high water use efficiency, and the evaporation loss of water is less because water is applied to the reservoir in the wicking bed. This system keeps the soil moist all the time. Wicking bed are suitable where watering is infrequent.ie, the water reservoir in a wicking bed can carry enough water to keep the plants alive for up to several weeks depending on climate, season and location. As the soil on the surface is drier, the establishment of weeds are not easily possible. It favors the improvement of soil quality or soil life. And also, this setup can be used for planting of crops upto 6 seasons. Even though the initial setting up charges are high for this system, it can be amortized to 3 years (Greeshma *et al*., 2023).

Constraints

Wicking beds require some technical skills to build properly. Some plants require a wet-dry cycle to grow, but wicking beds create an environment with constantly moist soil which is unsuitable for some plants. Wicking beds have the issue of accumulation of salts in the upper layer of soil. It is time consuming to build compared to other irrigation systems.

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