# Planting Tray

## Field of the Invention

This invention relates to a planting tray particularly for use on roofs.

## Background of the Invention

Cities tend to be much warmer than surrounding rural land due to the build up of heat in the buildings that make up the city. It is known to "green" building roofs, particularly high rise buildings, by covering them in growing plants/gardens to provide amenities for occupants of the buildings, to reduce reflected heat, and to improve the environment generally by absorbing rainwater, carbon dioxide etc..

Existing green roofs may be grown *in situ* in planting medium supported on various layers including waterproofing, a root guard layer drainage layer etc.

Such systems do not work with all type of roofs. For example in Singapore, public residential buildings have a particular type of roofing system in which ferro-cement slabs are supported above the main concrete roof of the building. These have the advantage of insulating the main roof of the building with an air gap. However, the slabs themselves get very hot and can exceed temperatures of $55^{o}$ or more on hot days. The ferro-cement roof reflects much heat to surrounding buildings. The roofs typically carry electrical and mechanical services which makes it difficult to use traditional greening methods.

In order to address such issues it is known to provide planting trays which sit on top of the cement slabs. WO2007/050042 discloses one such system, as does PCT/US01/22799. However these systems tend to be expensive and complicated to install. With the system of WO2007/050042 in particular once installed, as all the trays are inter-engaged, it is difficult to simply remove one tray which may contain dead or dying plants for replacement with another as all the trays are interconnected and need to be pushed apart to remove or add a tray.

A second problem with systems of the type described in WO2007/050042 is that the sealing between the pipes linking the trays together is not always reliable and can lead to water leaking onto the roof.

Any discussion of documents, acts, materials, devices, articles or the like which has been included in the present specification is solely for the purpose of providing a context for the present invention. It is not to be taken as an admission that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed before the priority date of each claim of this application.

**Summary of the Invention**

In a first broad aspect of the invention there is provided a planting tray for use on roofs or the like, including a tray or reservoir for retaining water, a structure supported above the reservoir and one or more wicks supported by the structure and depending into the reservoir for wicking water from the reservoir.

Typically, the wicks will include a first portion which depends into the reservoir and a second portion which extends on the structure perpendicular to the first portion.

The second portion may be covered by a fabric layer, such as a geo-textile and a layer of planting media.

The use of wicks is particularly advantageous with young plants whose roots may not be extensive and may not reach the reservoir.

The planting tray may define a reservoir having a base and side and end walls and a ledge extending around the internal perimeter of the reservoir. The lower part of the reservoir may be divided into cells by internal walls. One or more outlets/exits may be define at a height above the base which is approximately at or slightly lower than the height of the ledge above the base.

A perforated plate may rest on the ledge and or internal walls, on which the geo-textile layer rests in use. The plate may define, typically cruciform perforations for drainage of water as well as apertures for the wicks to pass through. The part of the plate which covers the exits may be solid and unperforated and higher, in use, relative to the rest of the plate.

The exits/outlets may be in fluid communication with sockets defined on the underside of the tray for receiving spigots in fluid communication with a network of pipes, thus allowing drainage of water to the network of pipes. The connection between the spigots and the sockets may be non-permanent allowing removal and replacement of trays.

Elongated recesses or tunnels may be defined on the underside of the tray for receiving pipes in use.

Thus in a second aspect of the present invention there is provided green roof system for use on roofs or the like, including:-

An array of interconnected pipes arranged on a substrate such as a roof, the array defining a plurality of upwardly extending spigots; and

a plurality of trays or reservoirs for retaining water, the trays having a base and walls and wherein the base is configured to locate over and receive the pipes and

defines a socket for connection with the spigot for transfer of fluid such as water from the tray to the array of pipes.

The spigots may be defined by pipe joiners connecting lengths of pipe together. The joins between the pipes and pipe joiners may be covered in a flexible seal.

The sockets are preferably defined at one side of the tray.

Typically each tray defines two sockets and interconnects with two parallel pipes.

Each tray may define a flange for use in connecting the trays together.

The trays may be pre-planted with the desired vegetation in a nursery environment prior to installing on top of the pipe network to achieve instant greening of the rooftop. Alternatively, the trays may be planted in-situ and installed on top of the pipe network immediately.

The planters provide a number of advantages including immediate realisation of extensive greens roofs, reducing heat transmission, lowering ambient temperature and mitigating the heat island effect as well as improving air quality, aesthetics and reducing rainwater run off.

For in-situ planting, the ability to install individual trays on the pipe network only after each tray is planted also does away with the need to install the whole green roof system before planting commences. This prevents rainwater retention in empty pre-planted trays and green roof systems, and the consequent breeding of mosquitoes.

**Brief Description of the Drawings**

A specific embodiment of the present invention will now be described by way of example only and with reference to the accompanying drawings in which:-

Figure 1 is an isometric view of a planter embodying the present invention attached to pipes of a drainage system;

Figure 2 is an end view of the planter of Figure 1;

Figure 3 is a side view of the planter and pipe of Figure 1;

Figure 4 is an isometric view of the tray of the planter of Figure 1 showing some components removed to illustrate otherwise hidden features of the planter;

Figure 5 is a similar view to Figure 4 but including a mesh root guard;

Figure 6 is a similar view to Figure 5 but further including a geo-textile layer;

Figure 7 is a similar view to Figure 5 but further including a intersecting erosion guards;

Figure 8 is a view of the underside of the planter of Figure 4;

Figure 9 is a similar view to Figure 8 but further including pipe joiners;

Figure 10 is a similar view to Figure 9 but further including pipes and seals; and

Figure 11 is an isometric view from the front and underside of the planter illustrating the pipe joiners in particular.

**Detailed Description of a Preferred Embodiment**

Referring to the drawings, Figures 1 to 3 illustrate a planter (10) embodying aspects of the present invention. The planter is shown attached to two pipes (12) of a pre-laid drainage system or grid into which the planter (10) may be plugged.

The planter comprises an open tray or reservoir (14) having a generally square contoured base (16), side walls (18, 20) and end walls (22, 24). An external flange (26) extends around the top of the side and end walls. The flange defines holes for receiving joining pegs (28) described in more detail below, for connecting adjacent planters to one another. The planter also defines rodent barriers (30) which extend from each corner at 135 degrees to each of the side/end walls. These act as a barrier to rodents passing between adjacent trays and infesting the spaces between the trays. The rodent barriers (30) snap fit between two elongate protrusions (31) defined at each corner of the tray (refer to Figure 4), and are optional as they are not required for all planters.

Figures 4 to 8 illustrate the planter in more detail omitting some components in order to show those components and features which are normally hidden in use.

Figure 4 shows the basic moulded tray (14) but also shows L shaped wicks which are not part of the moulded tray. As can best be seen in Figure the base (16) defines two parallel spaced apart tunnels or recesses (33, 34) which extend from one end (22) of the tray (14) to the opposite end (24). In use, as is described in more detail below, the recesses receive the pipes (12) of the drainage grid. At one end (24) of the tray there are two exit holes or outlets, (35, 36) through which water may flow into or out of the tray (14). The exit holes (35, 36) are at a height of just under half the height of the wall and when the water level in the tray reaches that height the water flows out of the tray via the exit holes.

A ledge (37) extends around the perimeter of the interior of the tray (14) at a height just above that of the exit holes (35, 36). The lower part of the tray below the ledge (36) is divided into a series of discrete cells by a series of four internal dividing walls (38) which extend from one side wall (18) to the other (20) and, four internal dividing walls (40) which extend from one end wall (22) to the other (24). The dividing walls (38) define small notches (42) over which water may flow from one cell to another and some deeper notches (43). The small notches allow water to flow down the slope (form one end to the other) from one cell to the next, and the walls keep the

level of water higher in each cell without making the growing medium waterlogged. If there were no side to side dividing walls the water level would be much lower at the higher end and consequently the volume of water stored would be less. Also the water level would be further away from the growing medium which would make the wicks less effective. The dividing walls (40) define generally deeper notches (44), except where the depth is constrained by the recesses (33, 34). This allows water in the tray to flow more easily from one side to the other which reduces the number of wick required as the cells joined by the deeper notches effectively function as a single cell.

Figure 4 also illustrates L-shaped wicks (46) which in use are supported by a mesh plate not shown in Figure 4.

Figure 5 shows the tray of Figure 4 but including a mesh root guard or grid (48) in the form of a perforated plastic plate which is supported on the top of the dividing walls (38, 40) and ledge (37). The root guard (48) defines an array of cruciform holes (50), as well as a number of elongate slits (52) through which the wicks (46) extend. The slits define a number of opposed teeth (51), of which only one side can be seen in the Figure as the opposite side is hidden by the upper part (46a) of the wick. The teeth flex and grip the wicks. As can be seen the top parts (46a) of the wicks (46) rest on top of the mesh root guard (48). The wicks may be made of any suitable material such as strips of geo-textile. The mesh root guard is solid and unperforated raised where the guard covers the outlets (32, 34) at (48a). Importantly the guard (48) substantially extends to the walls of the tray on all sides. This provides a solid barrier and an air gap between the planting medium above the guard and the outlets (32, 34) which inhibits roots from blocking and accessing the exits (35, 36).

Figure 6 shows the mesh guard (48) covered in a layer of geo-textile (60). This is typically a non-woven needle staple fibre ("SF") polyester geo-textile.

Figure 7 shows erosion guards in the form of three parallel spaced dividing walls (61) which extend from one side wall (18) to the other (20) and three spaced dividing walls (62) which extend from one end wall (22) to the other (24) and which divide the planter into sixteen generally square cells. The dividing walls define pegs (66) at their ends which mount in annular columns located adjacent the sides and end walls of the tray.

The erosion guards (61, 62) help prevent the planting material moving during transport of the tray and/or due to wind and other environmental effects when installed.

Figures 8 to 10 illustrate the underside of the tray and the attachment of the tray to pipes. The underside of the tray defines outlets (70) which are in fluid communication with the exit holes (35, 36). The outlets define coaxial circular portions

with an annular gap (71) between them which act as a socket for receiving a spigot of a pipe joiner.

Figure 9 illustrates a pipe joiner (72) attached to the sockets (60) on the underside of the tray. Each pipe joiner defines two parallel short lengths of pipe (74) which in use connect to the pipes (12), linked by a connecting piece (75) which also defines an annular shroud (76a) which receives a connector peg, in use. A spigot (76) , not shown in Figure 9, but partly visible in Figure 11, extends up from each pipe (74) and locates in the socket (71). Figures 10 and 11 illustrate pipes (12) attached to the pipe joiner (72) and watertight seals (78) extending around the joints between the pipe joiners 72) and the pipes (12).

In practice the pipes (12) are first laid out on the roof linked together with pipe joiners (72) and seals. Each pipe joiner defines two upwardly extending spigots which can be inserted into the sockets defined on the underside of the planters (10). The planters are then simply placed on top of the pipe joiners and plugged into the pipe network. The roof will typically have a small degree of slope to allow for drainage and when correctly positioned, the outlets of each tray are at the lowermost end of the tray and the pipes (12) follow the slope of the roof. The planters are then inter-engaged using the joining pegs (28)which provide reliable bayonet type connections. As can be seen in Figure 1, the flange (26) is lower on two adjacent walls (26a) and higher on the opposite two walls (26b) and the higher part sits over the lower part of an adjacent tray and the peg is inserted into the aligned holes (27) and rotated through 90 degrees to lock the trays together. This also prevents the trays being incorrectly assembled and ensures the outlets are always on the same side of the trays. The interconnected trays (14) serve as a storage reservoir for water during wet periods which can be used by the plants in dry periods thus reducing the amount of watering/maintenance needed for the planters.

For high wind areas where there is a risk of typhoons a longer peg is used in the hole between the exits a longer peg is used in the shroud (76a) and this connects the tray (14) to the pipe network which may be fixed to the roof by means of screws or bolts passing through holes in the pipe joiners. Rodent barriers (30) are typically used on the planters which form the perimeter of the installation to form an external barrier wall denying access to the interior of the installation to rodents.

One important advantage of the invention is that it is relatively easy to remove one tray from an array of trays without having to remove adjacent trays and dismantling any part of the drainage pipe network. Trays may be required to be

removed from time to time for replacement, for example, if the plants in the tray are diseased or dying or for access to the roof below the trays for maintenance.

The use of wicks to provide water to the planting medium and the air gap provided over the outlets (35, 36) reduces the tendency for the roots of the plants to move to the lower part of the tray to seek water, potentially blocking the outlets. The wicks also keep the planting medium wetter than other systems where evaporation of water or direct access to the water by plant roots is the medium of transfer of water to the planting medium.

The planter may be moulded in any suitable material, particularly plastics materials, however to provide a lightweight robust planter, high-strength UV-stabilised polypropylene the preferred material. The total weight of the tray and components saturated planting media, maximum stored water and plants is less than 30kg.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

CLAIMS:

1. The steps, features, integers, compositions and/or compounds disclosed herein or indicated in the specification of this application individually or collectively, and any and all combinations of two or more of said steps or features.