A plant tray for propagating plants, a tray, and methods.

The invention relates to a plant tray for propagating plants. The tray comprises a cup for retaining a plant growing medium and a seed, a cutting and/or a plant at least partly embedded in the plant growing medium. The cup has a bottom structure that is penetrable for a plant root growing in a downward direction. Further, the tray comprises a spacer extending downwardly, beyond the bottom structure of the cup. Further, there is provided a tray having adjustable cups.
Title: A plant tray for propagating plants, a tray, and methods

An aspect of the invention relates to a plant tray for propagating plants, comprising a cup for retaining a plant growing medium and a seed, a cutting and/or a plant at least partly embedded in the plant growing medium, the cup having a bottom structure.

In the field of horticulture/agriculture, plant trays are widely used for growing seeds and plants. The plants are placed in plant trays made of cups with open bottoms or closed bottoms, or in the ground.

Trays with open bottoms are used in two ways: they are placed on a surface – being a growing table – resulting in the root tips not being able to grow further and make an angle while being on the end – or on the soil – resulting in root tips growing in the soil which will break once the trays are lifted. Or cups with an open bottom are 'hanged' in such a way so that the root tips growth is stopped by the air ("airpruning") once they come out of the tray below. However, then while being transported in a box, on a car or while planting being placed on the ground the root tips break. This means that the roots have open wounds where fungi find an easy entrance to enter and infect the roots with diseases. Once broken or infected it means that the root has lost its capacity to quickly enter the soil in order to search for water and minerals. Trays with closed bottoms are also used resulting in the root tips not being able to grow further and make an angle while being on the bottom. Both technologies also force to take the plant with its roots out of the cup in order to plant it in the soil, resulting in damaging the root tips. A problem caused by the use of non-biodegradable trays is that the plant with the roots have to be taken out the cup once being planted. However, if the soil-medium has not been grown well through by the roots, the soil falls apart while planting, this way causing the breaking of the roots. In order to prevent the soil falling apart, growers put their plants for a longer growing period in the cup so that the
primary and secondary roots grow well through the soil medium. This results in horizontal and upward growing primary roots – who are only allowed to grow vertically down – and round growing secondary roots, who are only allowed to grow horizontal. It also results in a too long growing period in the cup which results in infection with root diseases.

During the production of the young plant, in cups with a closed bottom or with an open bottom but being placed on a growing table, primary roots grow downwardly towards the bottom of the cup, there they cannot grow further so they turn around – growing horizontal – then they touch the sides of the pot - and start to grow upwardly. In the meantime, secondary roots growing normally in a sideward direction consume the larger part of available growing energy until the cup is entirely traversed by a plant root structure. This way they start to grow downwards, horizontal, rounded and up again, against their own nature. When a plant is placed in the ground, normally the primary roots grow downwardly to contact ground water, however, once the first primary root is being forced through the cup model in a horizontal or even upward growing direction, it does not grow downwards again. The secondary roots who should have grown in a sideward direction, but as a cause of the present model of the cups have grown in each direction also lost their natural way of growing horizontal.

It is essential for the plant to reach the capillary hang water level and/ or the ground water level. Otherwise, irrigation is needed to survive, especially in dry or rocky subsoil.

In a first aspect of the invention it is an object of the invention to provide a plant tray providing improved surviving conditions for a plant after having grown in the tray. Thereeto, it is an object of the invention to provide a plant irrigating system having a reduced cost price. Thereeto, according to the invention, the bottom structure of the cup is penetrable for a plant root growing in a downward direction, while the tray comprises a spacer extending downwardly, beyond the bottom structure of the cup.
The invention is partly based on the insight that primary roots grow very fast to the bottom part of the tray. As present trays are made of plastic the primary root that is downwardly growing, arriving at the bottom, is not able to penetrate it, and starts to grow in a horizontal direction and mostly even upwardly. Once the root grows horizontally and/or upwardly it is not able anymore to grow downwardly and its function, growing down in the soil searching for water, gets lost. In the occasion that trays have an open bottom structure and the primary root grows downward and remains on the bottom, this root gets easily broken during transport. By providing a bottom structure that is penetrable for a plant root growing downwardly, it is counteracted that the primary root turns and grows upwardly in the cup. Further, by providing a spacer that extends downwardly, beyond the bottom structure of the cup, an air barrier can be formed below the bottom structure, reducing and/or even temporarily stopping the growth of the primary root (“airpruning”). Then, other root components, such as the secondary roots may grow during the plant’s stay in the cup. By providing the spacer extending beyond the bottom structure of the cup, the tip of the primary root protruding through the cup’s bottom is mechanically protected during transport/storage. Since the primary root tip(s) is/are protected on the bottom side, there is a very low chance that the tip(s) will be damaged during the planting process. This way, the roots will stay intact while planting so that they can immediately fulfill their growing function. Further, since wounding of the roots will hardly or not occur, also the entrance of funguses or microbes into the root structure is counteracted compared to planting according to the classic methods. As a consequence, plants stay more healthy and need less herbicides/fungicides for recovery and less water for growth. Once, the plant with the cup is placed in the ground, the primary root will continue growing, downwardly, to reach the ground water level. In this way, the primary root growth is optimally controlled and prepared for growth in the ground, thereby improving surviving conditions of the plant in the ground, especially in dry and rocky subsoil.
Preferably, a side wall of the cup is provided with a local structure that is penetrable for a plant root growing in a sideward direction, thereby enabling roots to grow through the cups side wall. This enables the secondary roots to follow their nature and grow through the cups side wall. The local structure might even help the primary root system – if there are more developed primary roots then one for instance in the case with cuttings – to penetrate these structures.

For example, the local structure (e.g. providing root gangways) can be formed by e.g. one or more local side wall partitions that are thinner than surrounding side wall sections, and/or one or more local incisions, or a similar structure, being penetrable for a plant root growing in a sideward direction.

In a highly preferred embodiment, the plant root penetrable structure is located at a radially inwardly protruding part of the side wall. Then, also root tips protruding through the side wall are mechanically protected during transport and/or planting.

Another positive effect of embodiments of the plant root penetrable structure (e.g. root gangways) is that if the roots have not penetrated them, the soil medium doesn’t dry out because of evaporation which results in a better internal climate, less water use and less remaining minerals as minerals stay behind while the water evaporates resulting in salination of the soil. Then, while the root tips are penetrating the gangways, they open like a door. The same is valid in case the bottom of the tray that exists of a ‘lip closure’. By having constructed it in a way that they close like ‘lips’ they close the cup mechanically until the primary root tips open it.. Through this way the structures in the a side wall partition and the bottom ‘lip closure’ give the possibility for the roots to penetrate but in the same time they allow the user to use any kind of soil, even loose sand, as the soil cannot leave through the side wall and the bottom.

Besides, as a consequence, the entrance of funguses into the primary root(s) is not only counteracted, but also entrance into the secondary roots
structure is counteracted, thus further improving surviving conditions of the plant.

The plant root penetrable structure (e.g. a respective partition) also helps preventing the root tips from being dried out too quickly during the planting process. Many times growers take out the plants in dry or hot circumstances and plant them. Not only damage the root tips mechanically, but many times they ‘burn’ because of a sudden draught while taking them from the protected atmosphere inside the cup to the windy, hot and sunny atmosphere outside the cup. Also, while planting, the first hours the root tips are in a dry soil that has a hygroscopic effect on the root tips. This effect is only solved when irrigation starts, but many times the damage between planting and the start of the irrigation already has taken place.

Advantageously, a side wall of the cup has locally a gas permeable structure, so that base material of the plant tray can be saved, exchange of gasses, such as O₂ and CO₂ between the plant growing medium and the atmosphere is stimulated, and the development of fungus is counteracted.

In a preferred embodiment, the plant tray includes an adjustable cup, particularly a cup that can be brought from a relatively flat transport condition to a operation condition for holding the growing medium. For example, the adjustable cup can include at least two cup sections that can be mutually moved from a first state to a second state, wherein inner sides of the cup sections are positioned away from each other when the cup sections are in their first state, wherein the inner sides form a cup’s inner side, for retaining the plant growing medium, when the cup sections are in their second state.

For example, the resulting cup can be 100% nestable (i.e. to a compact stack) when respective cup sections are in their first state.

The present patent application also relates to a method.
Another aspect of the patent application relates to an improved tray. Optionally, this second aspect may be combined with the above-described first invention.

JP2003070364 discloses a tray having seedling pots, made using a pulp moulding process. A disadvantage of the known tray is that the pots are relatively low, compared to their width. Besides, the pots all contain relatively large central through-holes in their bottoms, allowing leakage of content (e.g. a plant growing medium) and swift drainage of water during use. Besides, in the known tray, chances are relatively high that a seedling’s primary root will encounter the bottom of the seedling pot without finding the through-hole, resulting in horizontal and upward growing primary roots, leading to a too long growing period in the cup and infection with root diseases.

The second aspect of the invention aims to provide an improved tray. Particularly, this aspect aims to solve or at least alleviate the problems that are encountered with the known tray.

To this aim, there is provided a tray, wherein the tray has been manufactured by a pulp moulding process, the tray comprising at least one cup, the cup having a bottom structure that is preferably penetrable for a plant root growing in a downward direction,

wherein each cup is adjustable, having at least two cup sections that can be mutually moved from a first state to a second state, wherein inner sides of the cup sections are positioned away from each other when the cup sections are in their first state, wherein the inner sides form a cup’s inner side, enclosing a cup’s interior space, when the cup sections are in their second state, the moulding process including manufacturing the tray with the cup sections in their first state.

In this way, the tray can be provided with cups having improved shapes, e.g. relatively high cups (with a height that is significantly larger than a cups width), relatively narrow cups, e.g. narrow substantially tapered cups
having inner side walls including relatively small top angles (e.g. smaller than 45 degrees).

In a further embodiment, the bottom structure is penetrable for a plant root growing in a downward direction. This can be achieved in various ways as is described throughout this patent application. For example, the bottom structure can include a small aperture, or a local portion with a relatively small thickness, or a slit, cut or incision, or a ‘lip closure’ opening, being penetrable for a growing primary plant root.

Also, this second aspect of the invention includes the advantageous manufacturing method as is defined by claim 39.

There is provided a method of manufacturing a tray, for example a tray as described above, the tray comprising at least one cup, preferably at least one row of cups, wherein a pulp moulding process is used, the method being characterised in that the tray is moulded by the pulp moulding process with cup sections of each cup in a first state, in which first state inner sides of the respective cup sections are positioned away from each other, wherein after the moulding the cup sections of each cup can be adjusted from the first state to a second state for enclosing a cup’s interior space of the respective cup.

Further advantageous embodiments according to the inventions are described in the following claims.

By way of example only, embodiments of the present inventions will now be described with reference to the accompanying figures in which Fig. 1 shows a schematic perspective view of a plant tray according to the invention;

Fig. 2 shows a schematic perspective view of a cup of the plant tray of Fig. 1;

Fig. 3 shows a schematic perspective cross-sectional view of the cup of Fig. 2 accommodating a first plant;
Fig. 4 shows a schematic perspective cross-sectional view of the cup of Fig. 2 accommodating a second plant;

Fig. 5 shows a schematic perspective view of cups of other plant trays according to the invention;

Fig. 6 shows a flow chart of an embodiment of a method according to the invention;

Fig. 7 shows a schematic perspective view of an example of a cup of an embodiment according to the present inventions;

Fig. 8 shows a detail Q of Fig. 7;

Fig. 9 shows the embodiment of Fig. 7 in a folded-open condition;

Fig. 10 shows a tray including a plurality of cups of Figs. 7-9, in a folded-open state;

Fig. 11 is similar to Fig. 10, showing an alternative embodiment of the tray; and

Fig. 12 is a front view of a further embodiment of the invention.

It is noted that the figures show merely preferred embodiments according to the present inventions. In the figures, the same or corresponding reference numbers refer to equal or corresponding parts.

Figure 1 shows a schematic perspective view of a plant tray 1 according to the invention. The plant tray 1 is applicable for propagating plants and/or seeds. The plant tray 1 has a multiple number of cups 3. The cups are mutually connected, preferably via a detachable connection. Figure 2 shows a schematic perspective view of a single cup 3 of the plant tray 1. During use of the plant tray, the cups 3 retain a plant growing medium 5 and a seed 6 and/or a plant 7 at least partially embedded in the plant growing medium 5 as illustrated in Figures 3 and 4 showing a schematic perspective cross-sectional view of the cup 3 accommodating a first plant and a second plant, respectively. On the upper side, the cup 3 has an opening 8 allowing an accommodate plant 7 to grow in an upward direction UD. The cup 3 further has a bottom structure 9 that is penetrable for a primary root 10 of the plant 7
growing in a downward direction DD. Further, the tray 1 includes a spacer extending downwardly, beyond the bottom structure of the cup 3.

The bottom structure 9 as such can be configured and shaped in various ways, as will be appreciated by the skilled person. For example, the bottom structure can be flat, concave or convex, when viewed in a top view (i.e. in downward direction DD). Also, the bottom structure can be flat, concave (c.f. Fig. 12, described in more detail below) or convex, when viewed from an opposite bottom view (i.e. in an upward direction UD).

The tray 1 is applicable for use in the field of horticulture / agriculture. Plants, such as vegetables, bushes, trees or flowers, can be grown in the cups 3. Thereafter, the cups 3 are filled with a plant growing medium, e.g. ground, clay, substrate such as rock wool, perlite, flug sand, coarse granulates and/or peat soil. If biodegradable based materials are used for manufacturing the plant tray 1, in principle any kind of plant growing medium can be used. With the conventional trays the soil has to form a cup model and is not allowed to fall apart while planting in order not to cause breaking roots, because in the known planting method, the plant plug is taken out of the plastic cup before planting. By using a cup made from biodegradable material, any local soil, even soil that has no adhering structure, may be used. This means that the growth of plants becomes world wide possible on the spot. In case of using non-biodegradable cups, after the plants have grown, the plant growing medium including the root structure, also called root plug, can be removed from the cup for planting in the ground. If biodegradable material is used for manufacturing the cup, the step of removing the plug from the cup can be omitted, thereby advantageously avoiding that damage may occur on the roots of the plant. If when using a bio-degradable cup a seed doesn't germinate and a cup is without a plant, the cup including the soil medium can be mixed and re-used together for the next planting. Small plants or seeds are embedded in the plant growing medium. During use, the tray 1 may be placed on a surface 13, e.g. on a desk,
in a stand, or on a floor, for instance in a glass house. After the plants have grown, the plants can be put in another environment, e.g. in the ground.

According to an aspect of the invention, each cup 3 is provided with a spacer 12 providing an air chamber 11 (i.e. a primary root receiving space) located below the bottom structure 9 of the cup 3. The spacer 12 counteracts that the bottom structure 9 of the cups 3 contacts a surface 13 carrying the tray 1. In the embodiment shown in Figures 1-4, the spacer 12 includes four legs 14. However, also another multiple number of legs 14 can be applied, e.g. two, three or five legs, or more. In principle, also a single leg can be used.

Optionally, a leg is provided with a foot or a bottom plate providing extra stability to the tray 1. Further, it is noted that the spacer can be implemented in another way, e.g. as a tube extending below the bottom structure 9 of the cups or as a separate module supporting the cup 3. It is also noted that, instead of providing each cup 3 with a spacer, the tray may include a spacer structure that provides for a chamber 11 extending below the bottom structure 9 of all cups 3. Such a spacer structure may e.g. include four legs located at the bottom corners of the tray.

The length of the spacer is chosen such that an air barrier is realized between the bottom structure 9 of the cup 3 and a surface 13 supporting the plant tray 1. As an example, the height of the air barrier can be chosen in a range between circa 0.5 cm to circa 20 cm. In the embodiment wherein the spacer includes legs, also the length of the legs may e.g. range from circa 0.5 cm to circa 20 cm. In a non-limiting embodiment, a height of the air barrier can be relatively large with respect to a height of an interior 4 of the respective cup 3. For example, the height of the air barrier can be at least 10% of the height of an interior spacer 4 of the respective cup 3, and particularly at least 15%.

Alternatively, the height of the air barrier can be smaller than 10% of the height of an interior spacer 4. A minimum height of the air barrier can e.g. be 1 mm, particularly 2 mm. It is expected that an air barrier having a
height higher than 0.2 cm, for example at least about 0.5 cm, will lead to better results.

Figures 3 and 4 show embodiments wherein the inner surface 20 of the cup 3 is substantially tapered downwardly. As an example, the lower side of the inner surface 20 is formed as (truncated) cone, a (truncated) pyramid or a rounded tapered structure such as a ball segment. In a horizontal cross section 3CS of the cup 3, the inner surface may be shaped as an oval or circle. However, the cup might also have another contour, in a horizontal cross section, such as a polygon, e.g. a triangle or square, plus, flower or star shape.

By applying the tapered construction, an optimal respect ratio between the circumference, the content of the cup and its rigidity can be obtained. Further, the inner surface of the cup may be tubular shaped, preferably having a constant diameter.

During use of the tray, the cup 3 retains the plant growing medium 5. The kernel 6, from which the plant 7 is growing, is located in the plant growing medium 5. A primary root 10 is growing from the kernel 6 in the downward direction DD. Here, the bottom structure 9 of the cup 3 comprises one aperture 25 allowing the primary root 10 to grow through the bottom 9 of the cup 3.

As an alternative to providing a single aperture, the bottom structure 9 may comprise a multiple number of apertures and/or a material that is penetrable for a growing primary plant root. For example, the bottom material comprises paper material, for instance including cardboard, cellulose, paper foam and/or fiber paper. Further, the bottom structure might include a local portion with a relatively small thickness.

As a further alternative to providing an aperture, the bottom structure 9 may comprise a slit, cut or incision, or a ‘lip closure’ opening, being penetrable for a growing primary plant root.

Advantageously, a cup bottom made of primary root penetrable material comprises a relatively weak area, e.g. formed by a local constriction of
the thickness in the bottom, or by a local through-cut or incision, a ‘lip closure’ opening, or by applying a weaker material in the relatively weak area. However, it is noted that the bottom of the cup does not need to have at least one hole or at least one relatively weak area. For example, the whole cup may be relatively weak. Alternatively, the cup may be relatively strong, but the material can be weakened during use. For example, a part of water fed to the plant may work its way down through the plant growing medium 5 and may remain on top of the bottom structure 9, thereby attenuating the bottom to such extent that the primary root may relatively easily pierce through it when it grows substantially in the downward direction DD.

Advantageously, the bottom structure 9 is substantially closed before being penetrated by a said primary plant root 10, particularly for preventing plant growing medium 5 escaping via the bottom. To that aim, for example, a said aperture 25 can be relatively narrow. Also, to that aim, very good results can be obtained using a said cup bottom made of primary root penetrable material comprises a relatively weak area, e.g. formed by a local constriction of the thickness in the bottom, or by a local through-cut, a slit or incision or a ‘lip closure’ opening.

The plant array can be placed on a closed surface or on an open structure, such as concrete netting or another supporting structure, enabling optimal air ventilation circumstances.

Further, the cup 3 has a side wall 21 provided with gas permeable portions 19, preferably at the top side 16 of the cup 3. The gas permeable portions 19 can facilitate an exchange of gasses, such air, carbon dioxide and/or oxygen, between the growing medium 5 and the exterior 17 of the cup. The gas exchange can counteract fungal grow and/or can promote the growth of the plant 7 and/or roots, such as secondary roots 18 of the plant 7.

The side wall 21 of the cup 3 as shown in Figures 3 and 4 is also provided with a local structure 28 that is penetrable for a plant root growing in a sideward direction. The penetrable structure 28 has preferably a mainly
elongated shape that is oriented downwardly to facilitate penetration by further primary plant roots 22 that grow in a direction with a downward component. However, the elongated shape might also be oriented in another direction, e.g. a sideward direction. Further, the penetrable structure 28 may include an opening, a multiple number of openings or a material that is penetrable for growing roots. Optionally, also the gas permeable portions 19 are penetrable for roots, so that secondary roots can grow through the gas permeable portions 19.

According to a further aspect of the invention, the inner surface 20 of the cup 3 is provided with inwardly extending protrusions 23, formed as downwardly extending ribs in the embodiments shown in Figures 1-4. By application of the inwardly extending protrusions, a growth direction of roots is guided. Roots that tend to grow in a circumferential direction are thus stimulated to grow downwardly, so that a more natural and balanced root structure is obtained. Ribs that extend inwardly and downwardly on the inner surface 20 of the cup 3 counteract that roots grow from a first circumferential section to a further circumferential section. Preferably, the inwardly extending protrusions 23 are mainly evenly distributed in the circumferential direction CD.

In addition, the tray 1 may include a single or a multiple number of downwardly extending ribs 24 attached to an outer surface of the cup 3 to provide a rigid structure.

By providing a cup 3 that has a side wall protruding radially inwardly and outwardly along a circumferential direction, a relatively rigid structure can be obtained. Moreover, specific features can be implemented in a desired part of the cup wide wall 21. As an example, a local structure 28 that is penetrable for a plant root growing in a sideward direction can be provided at an inwardly protruding part of the side wall 21, while a gas permeable structure can be provided at an outwardly protruding part of the side wall 21, as shown in Fig. 2.
It is noted that the cup 3 can be shaped in another way, e.g. without inwardly extending protrusions and/or without a downwardly extending rib attached to an outer surface of the cup. As an example, a cup having a pure circular cross sectional contour can be provided, e.g. for providing a simple design.

The embodiment of the plant tray 1 as shown in Fig. 1-4 comprises a multiple number of cups 3. The cups are arranged in a regular two dimensional array. As an example, the array includes four cups in a first direction x and six cups in a second direction y to meet standard plant tray sizes, such as the Danish and the European sized trays. Apparently, the tray may include another number of cups in the x-direction and/or the y-direction. Further, in principle, a single cup array can be provided according to the invention.

In the shown embodiment of Fig. 1, the cups 3 are detachably connected to each other. The connection can be realized by perforated lines 35, as shown, or otherwise, e.g. by pre-folding and/or providing local thin connecting lines, also called hinges. After growing, the cups can be disconnected. Alternatively, the cups are connected to each other in a solid way. Then, the plants can be removed from the cups, so that the tray can be reused for a new set of plants and/or seeds.

In an advantageous manner, the plant tray 1 according to the invention may comprise intermediate portions 30 interconnecting the individual cups 3 and including a water guiding structure for guiding water from the intermediate portions towards the cups 3, as shown in e.g. Fig. 1 and 2. The intermediate portions 30 are not flat but include tilted sections 31, 32 guiding water that is incident on the plant tray 1 towards the cups 3. The tilted sections 31, 32 form a corrugated pattern having local minima and local maxima. In the shown embodiment, the intermediate portions 30 include apertures 33 at local minima, so that in principle all water droplets may flow downwardly from the corrugated pattern. Then, the intermediate portions 30
may dry so that mechanical features of the tray do not deteriorate. Advantageously, the apertures 33 are located above the outer surface of the cup side wall 21, and above the local structures 28 that are penetrable for a plant root growing in a sideward direction, so that tips of outwardly growing roots 18 can be moisturized. As a consequence, less irrigation water is needed for growing the plant(s).

Figure 5 shows a schematic perspective view of cups 3 of other plant trays 1 according to the invention. On the left hand side a cup 3a is shown wherein both the local side wall structure 28 that is penetrable for a plant root growing in a sideward direction and the local side wall structure 19 that is gas permeable, include a mainly elongated portion oriented in a sideward direction. Instead of the strip shaped legs shown in Fig. 1-4, the legs 14 of the left hand side cup spacer are pillar shaped. On the right hand side a further cup 3b is shown. Here, both the local side wall structure 28 that is penetrable for a plant root growing in a sideward direction and the local side wall structure 19 that is gas permeable, include a mainly elongated portion oriented in the downward direction. Further, the spacer now includes two legs 14a,b having a curved strip shape.

Figure 12 depicts another advantageous, non-limiting embodiment of the invention. The embodiment of Fig. 12 differs from the examples shown in Figures 1-5 in that the bottom structure 309 of each cup 303 as such is shaped to define the spacer. In this embodiment, the bottom structure as such has a concave lower side (faced away from the cup’s interior), thereby also defining the respective air chamber below the bottom structure. In this embodiment, e.g., a first part of the bottom structure (for example a central part) can be penetrable by the plant root (e.g. in a manner as is described above). Another part of the bottom structure (e.g. enclosing a penetrable first bottom structure part) acts as a spacer, and extends towards a lower edge of the cup, downwardly beyond the first –penetrable- part of the bottom structure. For example, in this advantageous embodiment, the respective tray
301 is nestable. Also, in this example, the concave bottom structure may be formed to define a relatively small spacer, e.g. having a height that is about 1 cm or smaller, and for example at least about 0.2 cm. The resulting nestable tray configuration can provide a desired minimum airpruning, i.e. stopping further growth of a primary root after having penetrated the bottom.

Further, the plant tray may comprise a body including plant protecting and/or plant nutrition material. The body can be formed separately, e.g. as a ball or as a ring enclosing the cups. The ring may be added when positioning the cup in the ground, after growing in a conditioned space. As an example, the ring may be formed by connecting two ring members to each other, e.g. using a snap connection. Further, the body can be integrated with the plant tray.

The plant protecting / plant nutrition material may include aromatic substances, flavourings, such as camphor, chili or garlic, (artificial) fertilizer or micorrizhae, anti-fungal material and/or an insecticide, e.g. nicotine or borax for chasing away harmful animals such as termites, and/or fungi. Further, the plant protecting / plant nutrition material may include seeds, symbiotic bacteria, eggs, fungi and/or spores that may germinate after leaving the base material, thereby improving the biodiversity of the irrigating system. Further, the plant protecting / plant nutrition material may include material that damages harmful animals. Such material may include glass grindings, sand grindings, metal grindings, cement, lime, silicon, rubber or any material that damages harmful animals without poisoning. As an example, the cups might include a first plant protecting / plant nutrition material and the intermediate portions 30 may include a second plant protecting / plant nutrition material.

The number of seeds, fungi and/or spores can be determined before integrating in a base material.

Advantageously, the plant tray may include biodegradable material. As an example, paper material and/or biodegradable plastic can be used.
By using paper material and/or biodegradable plastic, the plant irrigating system can be manufactured in a very cheap way. Further, the environmental impact decreases. Some cardboard, paper foam and/or fiber paper types easily tear, thereby counteracting any theft of the system. The paper material may include cardboard, cellulose, such as paper tissue, paper foam and/or fiber paper.

As an example, the fiber paper may include coconut fiber, cotton fiber, banana fiber, jute fiber, wool fiber, straw fiber, grass fiber, hemp fiber, kenaf fiber, wheat straw paper, sunflower stalks fiber, rags fiber, mulberry paper and/or kozo.

The biodegradable plastic can be made of renewable raw materials, but it can also be based on petroleum based plastics including an additive making it biodegradable.

Generally, petroleum based plastics are known as hydro-carbons.

During a biodegradation process, microbes are enabled to metabolize the molecular structure of the plastic and to produce inert humus material, water and biogases, such as CH₄ and CO₂. An example of a biodegradable additive is the commercially available substance, known as EcoPure including organic compounds for opening the polymer chain of the hydro-carbons, and attractants stimulating microbial colonization on the plastics. The biodegradation occurs at the atomic level and is anaerobic or aerobic. As an example, a biodegradable additive can be applied for a wide variety of plastics, such as PVC, PE, PP, PS, PC, PET and PA.

Renewable raw materials for forming a biodegradable plastic may include wood fiber, e.g. 60%, combined with a plastic, e.g. 40%. When a suitable biodegradable additive is added, the material is made biodegradable.

Alternatively, other biodegradable material can be used, such as bamboo, sugarcane, hay, pulp or elephant excrement. Further, pre-pressed material can used, such as pre-pressed sawdust, peat, peat moss, rice chaff etc.
Preferably, material forming the plant tray includes water impermeable material and/or is provided with a liquid impermeable coating, e.g. on the inner and/or outer side. Further, the forming material can be coated with a biodegradable layer, preferably having a pre-determined thickness so that a desired degree of degradedness can be set. Alternatively or additionally, the degradedness of the biodegradable layer can be set by including a dosed amount of conserving material. Further, the degradedness can be set by localizing specific parts at specific heights with respect to the ground level. In general, material in the collection structure will degrade later than material in the reservoir, due to the position relative to the ground.

Preferably, the base material of the plant tray includes specific material that is bound to the base material for a specific time period and is then disseminated into the environment, due to degradable properties of the base material. By setting the degradedness of the base material, the degree of dissemination of the specific material can be determined. In this respect it is noted environmental parameters, such as wind, moisture etc may influence the degradedness of the base material.

Figure 6 shows a flow chart of an embodiment of the method according to the invention. After growing a plant in the plant tray, the plant can be planted in the ground. The planting process includes the step of providing 100 a plant tray comprising biodegradable material, the tray including a cup 3 retaining a plant growing medium and a plant embedded in said medium, and the step of placing 110 the cup 3 on the ground, without removing the plug from the cup, i.e. without removing the plant growing medium and a root structure of the plant.

Preferably, the method includes the step of removing a cup from the plant tray that includes a multiple number of cups, before placing the cup on the ground. Advantageously, the cup can be placed in a hole in the ground. Similarly, the method may include the step of covering a side wall of the cup at least partly with ground, so that the plug is embedded in the ground.
Figures 7-10 depict a further advantageous embodiment, including the aspects of the both inventions.

As in Figures 3 and 4, the embodiment shown in Figures 7-10, 12 includes cups, 103, wherein the inner surface of each cup 103 is substantially tapered downwardly. The lower side of the inner surface can be formed as (truncated) cone, a (truncated) pyramid or a rounded tapered structure such as a ball segment.

Preferably, (as in the earlier embodiments as shown in Figures 1-6, 12), the cups are relatively high compared to their (maximum) width. For example, a height H of each cup 3, 103 (the height H excluding the length of the spacer, if any) can be significantly larger than a maximum width W of the cup’s interior, for example by a factor of at least 1.5 and particularly by a factor of at least 2. Double arrows W and H in Fig. 10 indicate the height and width, respectively (the cup shown being in a first state, as explained below). Particularly, the cup’s height is the distance between the bottom 9, 109 of the cup and the top side 16, 116 of the cup, measured along a cup’s central axis. In this example, the maximum width W of the cup’s interior is the width measured at the top side, i.e. in a direction normally with respect to the cup’s central axis (i.e. the width of the top opening, leading into the cup).

In a further embodiment, said cup height H can be at least 5 cm, for example at least 10 cm. As is mentioned before, the maximum width W can e.g. be at most about half the height H (and may e.g. be at least about 1 cm).

Also, from the drawings it follows (as in the earlier embodiments as shown in Figures 1-6, 12), that the cups 3, 103 are relatively narrow, wherein the inner sides of the cups include relatively small angles φ (see Fig. 10) when viewed in a longitudinal cross-section. For example, the afore-mentioned angle φ can be smaller than about 45 degrees, for example an angle in the range of 0 to about 30 degrees.
Also, from the drawings it follows (as in the earlier embodiments as shown in Figures 1-6, 12), that each cup 3, 103 can be particularly narrow at its bottom 9, 109. As an example, the cup’s internal width K at the bottom (see Fig. 10), measured a direction normally with respect to the cup’s central axis, can be at most 50% of said maximum width W, and particularly at most 20% of said maximum width W.

The embodiment shown in Figures 7-10 differs from the examples discussed with respect to the figures 1-6, 12 in that the cup 103 is adjustable, having at least two cup sections 103x, 103y (only two, in this extra advantageous embodiment) that can be mutually moved from a first state to a second state. The first state of the cup 103 is shown in Fig. 9. Figure 10 shows a further embodiment, of a tray 101 having a plurality of cups with their cup sections in the first state. One major advantage is that the trays are nestable, at least when they are in their first (folded open) state. Also, a major advantage is that the tray, having the present extra advantageous (e.g. relatively elongated tapered) cup shape, can be made utilizing a pulp moulding process (known per se to the skilled person). An example of the manufacturing method is described below.

The adjustable cup 103 can be configured in various ways. For example, the cup sections can be provided by separate sections, that are not interconnected when they are in the first state, wherein the sections can be joined to form the cup 103. In the present example, the cup sections 103x, 103y are already interconnected before being brought into the second (operating) condition, as will be described below.

In the present example, inner sides of the cup sections 103x, 103y (i.e. respective cup wall sections 121x, 121y) are positioned away from each other when the cup sections 103x, 103y are in their first state (see Fig. 9). After the cup sections 103x, 103y have been brought in their second state (see Fig. 7), the inner sides (i.e. the cup wall sections 121x, 121y) together form a cup’s inner side, for retaining the plant growing medium.
When the cup 103 is in its first condition (i.e. the sections 103x, 103y are in their first state), it occupies relatively little space, which is very useful for storage and/or transportation. Thus, a large number of plant trays can be jointly stored, and transported to a final destination, using a minimum of space, leading to considerable savings in storage and transportation costs.

When the plant trays have arrived in their final destination, the respective cups can be assembled, i.e. the respective cup sections can be adjusted to their second state to form the cups, e.g. to be used in a method as is described above.

From the drawing it particularly follows that the cup wall, of this example, is divided into two wall sections 121x, 121y, opposite longitudinal wall edges joining each other when the cup 103 is in the second state (cf. Fig. 7), the longitudinal wall edges being spaced-apart from each other (and e.g. extending in line with each other, in the same plane, as in Fig. 9) when the cup 103 is in its initial first state. In the example, the two wall sections 121x, 121y basically are two cup halves, of the same shape and dimensions. The adjustable cup may also include adjustable wall sections having mutually different shapes and dimensions. In addition, the adjustable cup may also include more than two adjustable wall sections, for example three or four such sections.

The present cup sections of each cup 103 are interconnected by interconnecting profiles 151, for example winglets, that are made in one piece with the walls of the cup sections 103x, 103y. The present interconnecting profiles 151 may have e.g. a wall thickness that is about the same as a thickness of cup wall sections 121x, 121y.

In this example, each of the cup sections 103x, 103y is provided with two parallel interconnecting profiles 151, extending in opposite directions from the respective wall section, the two interconnecting profiles 151 of the first cup section 103x being integrally connected to the interconnecting profiles of the second cup section 103y. In an alternative embodiment, each of the cup
sections 103x, 103y can e.g. be provided with a single interconnecting profile for attaching the cup sections to each other.

From the drawing it follows that the present interconnecting profiles 151 protrude laterally from respective cup wall sections 121x, 121y (radially with respect to a cup’s centre line). In this case, the interconnecting profiles 151 extend along the entire height of the respective cup wall sections 121x, 121y. Also, in this embodiment (which includes both the first and second invention) the interconnecting profiles 151 extending downwardly, beyond the bottom structure of the cup, and provide respective spacer sections 112x, 112y forming the cup’s spacer 112 when the cup sections 103x, 103y are in the second state.

It is noted that in this example, the bottom structure 109 of the cup 3 is provided by bottom structure sections 109x, 109y of the respective cup sections 103x, 103y. The bottom structure sections 109x, 109y form the bottom structure after the cup sections have been adjusted to their second position. In that condition, the resulting bottom structure 109 is penetrable for a plant root growing in a downward direction, as has been described above. The present bottom structure sections 109x, 109y are spaced-apart (e.g. with external sides facing one another as in Fig. 9) when the cup sections are in their first position.

The interconnecting profiles 151 may be configured to pivotally connect the respective cup sections to each other. In the example, to this aim, the profiles 151 are provided with hinge/folding lines 150.

Also, preferably, the cup sections 103x, 103y are integrally provided (e.g. in one piece) with a locking structure 155, 156 for locking the cup sections together when they are in the second state. The locking structure 155, 156 can be part of the interconnecting profiles 151, and can e.g. be a clamping structure or a different type of locking means. In the example, interconnecting profiles 151 include clamping protrusions 155 and clamping through-holes 156 (having reinforced edges), cooperating with each other to hold respective
profiles 151 and the cup sections 103x, 103y together when the profiles 151 have been joined (cf. Fig. 8).

As follows from Fig. 10, the configuration described above regarding figures 7-9 can be used with great advantage in a plant tray 101, including a plurality of adjustable cups.

In Fig. 10, the cup sections 103x, 103y of all cups are all in their first state, providing a very compact, relatively flat configuration, for example for storage and/or transport of the plant tray. When the tray of the present embodiment is in the flat state, it is nestable; i.e., that a plurality of trays can be stacked onto each other, with cup sections (in their first state) of the trays nesting in each other. In the resulting stack, respective spacer parts 151 of different trays extend in parallel levels (each level being associated with a respective tray), thereby allowing a compact packing. In this example, in each row, the cup sections of mutually different cups 103 are integrally (in one piece) connected to each other by respective interconnection profiles 151 extending there-between.

In this non-limiting embodiment, the tray 101 includes at least two rows (particularly two) of cups 103. In the non-limiting example, each row includes five adjustable cups 103. The tray 101 can also include another number of rows of adjustable cups (for example one, three, four or more). Similarly, each rows can include another number of adjustable cups (starting with only one cup).

The cups 103 in the tray 101 are preferably detachable interconnected. To this aim, the respective interconnection profiles 151 can be provided with weakening lines, tearing lines, perforations or intermediate slits 152 (as in the drawing), as will be appreciated by the skilled person. Also, weakening lines, tearing lines, perforations or intermediate slits 154 (as in the drawing) can be provided between adjoining cup rows.

According to a further embodiment, the tray 101, or assembly of adjustable cups 103, can be manufactured in a very economical and efficient
manner by a pulp moulding process, for example (but not limited to) wood pulp, paper pulp, or pulp including wood and/or paper material.

An alternative example of a tray 201 only includes the second invention, and is shown in Figure 11, providing similar advantages as the tray shown in Fig. 10 regarding compactness and nestability during storage and transport, the tray’s cup(s) is/are not provided with the spacer(s) 112. In this alternative example, bottom sections 209x, 209y of each cup 203 can e.g. be pivotally connected with one another. Also, in this embodiment, the interconnecting profiles 251 extend e.g. towards but not beyond the bottom structure of the cup. In this example, the cup sections 203x, 2037 of each cup, and their respective interconnection profiles 251, are pivotally connected, via a hinge/folding line 150 extending there-between, for adjusting the cups between the respective folded-out and folded-in conditions.

It is observed that the example shown in Fig. 11 includes a single row of cups 103. Again, the tray 201 can also include another number of rows of adjustable cups.

Besides, according to a further embodiment, there can be provided a combination of embodiments according to Figures 10 and 11. For example, the tray can be provided with one or more rows of first cups that all include a spacer, and with one or more rows of second cups which do not include a spacer (in the latter rows, the cup sections of each cup can be directly interconnected via hinge or fold lines 250).

An aspect of the invention also provides a method of manufacturing a tray, for example a tray 101, 201 as is described above. The tray comprises at least one cup, preferably at least one row of cups. A pulp moulding process is used to manufacture the tray 101, 201.

The manufacturing includes the tray 101, 201 being moulded by the pulp moulding process with cup sections of each cup in the first state, in which first state inner sides of the respective cup sections are positioned away from each other (as in Figures 9, 10, 11). After the moulding, the cup sections of
each cup can be adjusted from the first state to the second state for enclosing a cup's interior space of the respective cup (see the example of Fig. 7).

The pulp moulding process can be carried out in various ways. An example, wherein pulp is poured and subsequently pressed into a mould, is described in JP200370364, included herein in its entirety by reference.

Alternatively, a mould can be used to scoop a layer of pulp from a pulp batch, for example a pulp bath. In the latter pulp moulding method, a pressing step (i.e. after pulp has been applied to the mould) can be left out.

The pulp as such can include various materials. Preferably, the pulp consists of biodegradable material. For example, in an extra advantageous embodiment, the pulp that is used mainly consists (for example by at least 90%, e.g. at least 99%) of wood pulp, paper pulp, or a combination of paper pulp and wood pulp. The pulp can include other materials as well, for example one or more of the materials that have been mentioned above.

In a further embodiment, the pulp contains liquid (e.g. water) when it is applied to the mould, wherein the pulp can be dried (i.e. the liquid is removed from the pulp) during and/or after the moulding.

The mould that is used can e.g. be configured to form all cup sections of each cup in their first state. Preferably, the method includes providing the tray with folding sections 150, 250 (e.g. hinge lines or perforation lines), for mutually folding the cup sections towards each other.

Preferably, the method includes providing the tray 101, 201 with locking structures, for mutually locking the cup sections to each other when they are in their second state.

Optional tray structures, e.g. said inwardly extending protrusions (forming root guiding structures), and/or said locking structures and/or said structures that are penetrable by a plant root, can be applied after the moulding, and particularly when the cup sections are still in their first state and therefore easily accessible (e.g. by a cutting device, a punch and/or another tool, suitable to mechanically act on the moulded pulp). The mould that is used
can also be configured to provide one or more such structures as part of the
moulding process itself.

Similarly, said folding sections 150, 250 (e.g. hinge lines or
perforation lines) can be formed in the pulp material during (as part of) the
moulding process itself, or there-after with the cup sections of each cup still in
their first state.

The invention is not restricted to the embodiments described herein.
It will be understood that many variants are possible.

It is noted that the spacer(s) can be either integrated with the plant
tray and/or or cups (e.g., each spacer can be made in one piece with the plant
tray), or can be manufactured separately to be assembled as a separate module
to the plant tray.

Other such variants will be apparent for the person skilled in the art
and are considered to fall within the scope of the invention as defined in the
following claims.
CONCLUSIES

1. Planttray voor de teelt van planten, omvattende een kom voor het vasthouden van een plantgroeimedium en een zaad, een stek en/of een plant die ten minste gedeeltelijk is ingebed in het plantgroeimedium, waarbij de kom een bodemstructuur heeft die doordringbaar is voor een plantwortel die in een neerwaartse richting groeit, waarbij de tray voorts een afstandshouder omvat die zich neerwaarts uitstrekt, voorbij de bodemstructuur van de kom.

2. Planttray volgens conclusie 1, waarbij de afstandshouder een enkelvoudig of een meervoudig aantal poten omvat.

3. Planttray volgens conclusie 1 of 2, waarbij de afstandshouder een luchtkamer definiëert die zich onder de bodemstructuur van de kom bevindt.

4. Planttray volgens één van de voorgaande conclusies, waarbij een zijwand van de kom lokaal een structuur heeft die doordringbaar is voor een plantwortel die in een zijwaartse richting groeit.

5. Planttray volgens conclusie 4, waarbij de voor de plantwortel doordringbare structuur een hoofdzakelijk langgerekt gedeelte omvat dat neerwaarts is gericht.

6. Planttray volgens conclusie 4 of 5, waarbij de voor de plantwortel doordringbare structuur is geplaatst bij een zich radiaal binnenwaarts uitstekend deel van de zijwand.

7. Planttray volgens één van de voorgaande conclusies, waarbij een zijwand van de kom lokaal een voor gas doordringbare structuur omvat.

8. Planttray volgens conclusie 7, waarbij de voor gas doordringbare structuur een hoofdzakelijk langgerekt gedeelte omvat dat zijwaarts is gericht.
9. Planttray volgens één van de voorgaande conclusies, waarbij een doordringbare structuur een opening, een insnijding, een snee en/of een spleet heeft.

10. Planttray volgens één van de voorgaande conclusies, waarbij de kom, in een neerwaartse richting gezien, in een doorsnede een ovale of cirkelvormige contour heeft.

11. Planttray volgens één van de voorgaande conclusies, waarbij het binnenvlak van de kom naar beneden toe in hoofdzaak taps toeloopt.

12. Planttray volgens één van de voorgaande conclusies, waarbij het binnenvlak van de kom is voorzien van zich binnenwaarts uitstrekkende uitsteeksels.

13. Planttray volgens één van de voorgaande conclusies, voorts omvattende een zich in neerwaartse richting uitstrekkende rib die bevestigd is aan een buitenvlak van de kom.

14. Planttray volgens één van de voorgaande conclusies, omvattende biologisch afbreekbaar materiaal.

15. Planttray volgens één van de voorgaande conclusies, omvattende een lichaam met plantbeschermend en/of plantvoedend materiaal.

16. Planttray volgens één van de voorgaande conclusies, omvattende een meervoudig aantal kommen.

17. Planttray volgens conclusie 16, omvattende tussenliggende gedeelten die de individuele komen onderling verbinden en die een watergeleidingsstructuur hebben om water van de tussenliggende gedeelten naar de kommen te geleiden.

18. Planttray volgens conclusie 16 of 17, waarbij de kommen losneembaar met elkaar zijn verbonden.

19. Planttray volgens één van de voorgaande conclusies, waarbij de kom ten minste twee komsecties heeft die onderling kunnen worden bewogen van een eerste toestand naar een tweede toestand, waarbij de binnenzijden van de komsecties van elkaar vandaan zijn geplaatst wanneer
de komsecties in hun eerste toestand verkeren, waarbij de binnenzijden een binnenkant van de kom vormen, voor het vasthouden van het plantgroeimedium, wanneer de komsecties in hun tweede toestand verkeren.

20. Planttray volgens conclusie 19, waarbij de komsecties van elke kom scharnierbaar met elkaar zijn verboonden.

21. Planttray volgens conclusie 19 of 20, waarbij de komsecties integraal zijn voorzien van een vergrendelstructuur voor het aan elkaar vergrendelen van de komsecties wanneer zij in de tweede toestand verkeren.

22. Planttray volgens één van de conclusies 19-21, waarbij de komsecties van een kom onderling verbonden zijn met behulp van onderling verbonden profielen, waarbij de onderling verbonden profielen afstandshoudersecties omvatten die de afstandhouder van de kom vormen wanneer de komsecties in de tweede toestand verkeren.

23. Planttray volgens één van de conclusies 19-22, omvattende een meervoudig aantal komen, waarbij elke kom ten minste twee komsecties heeft die onderling bewogen kunnen worden van de respectievelijke eerste toestand naar de respectievelijke tweede toestand, waarbij de komsecties allen in hun eerste toestand verkeren, bijvoorbeeld voor opslag en/of transport van de planttray.

24. Planttray volgens conclusie 23, waarbij de planttray is vervaardigd met behulp van een pulp moulding process (pulpvormproces).

25. Planttray volgens één van de voorgaande conclusies, waarbij de tray nestbaar is.

26. Planttray volgens één van de voorgaande conclusies, waarbij elke kom een concave bodemstructuur heeft, waarbij de concave bodemstructuur een sectie heeft die doordringbaar is voor een plantwortel die in een neerwaartse richting groeit, en waarbij de concave bodemstructuur een sectie heeft die als de afstandshouder dient die zich neerwaarts uitstrekt, voorbij de sectie die doordringbaar is voor de plantwortel.
27. Werkwijze voor het planten van een plant, omvattende de stappen van:
  - het verschaffen van een planttray omvattende biologisch afbreekbaar materiaal, waarbij de tray een kom die een plantgroeimedium vasthoudt omvat en een plant die is ingebed in het genoemde medium, en
  - het plaatsen van de kom op de grond.
28. Werkwijze volgens conclusie 27, voorts omvattende de stap van het verwijderen van een kom van de planttray die een meervoudig aantal komen heeft, voordat de kom op de grond wordt geplaatst.
29. Planttray volgens conclusie 27 of 28, waarbij de kom in een gat in de grond wordt geplaatst.
30. Planttray volgens conclusie 27, 28 of 29, voorts omvattende de stap van het ten minste gedeeltelijk met grond bedekken van een zijwand van de kom.
31. Tray, waarbij de tray is vervaardigd met behulp van een pulp moulding process (pulpvormproces), waarbij de tray ten minste één kom omvat met een bodemstructuur die bij voorkeur doordringbaar is voor een plantwortel die in een neerwaartse richting groeit, met het kenmerk dat elke kom een verstelbare kom is met ten minste twee komsecties die onderling bewogen kunnen worden van een eerste toestand naar een tweede toestand, waarbij binnenzijden van de komsecties van elkaar vandaan zijn geplaatst wanneer de komsecties in hun eerste toestand verkeren, waarbij de binnenzijden een binnenkant van de kom vormen, die de binnenruimte van de kom omsluit, wanneer de komsecties in hun tweede toestand verkeren, en waarbij het zogenaamde pulp moulding process het vervaardigen van de tray met de komsecties in hun eerste toestand omvat.
32. Tray volgens conclusie 31, waarbij de komsecties van elke kom scharnier met elkaar verbonden zijn.
33. Tray volgens één van de conclusies 31-32, waarbij de komsecties integraal zijn voorzien van een vergrendelstructuur voor het aan elkaar vergrendelen van de komsecties wanneer zij in de tweede toestand verkeren.

34. Tray volgens één van de conclusies 31-33, waarbij een hoogte (H) van elke kom significant groter is dan een maximale breedte (W) van elke kom, bijvoorbeeld met een factor van ten minste 1,5 en bij voorkeur met een factor van ten minste 2.

35. Tray volgens één van de conclusies 31-34, waarbij de komsecties van een kom onderling verbonden zijn met behulp van onderling verbonden profielen.


37. Tray volgens één van de conclusies 31-36, waarbij elke kom is gedefinieerd door slechts twee onderling verstelbare komsecties, in het bijzonder twee komhelften.

38. Tray volgens één van de conclusies 31-37, waarbij elk van de komsecties integraal twee parallele onderling verbonden profielen omvat, die zich vanaf de respectievelijke wandsectie in tegengestelde richtingen uitstrekkken, waarbij de twee onderling verbonden profielen van de eerste komsectie integraal verbonden zijn met de onderling verbonden profielen van de tweede komsectie.

39. Werkwijze voor het vervaardigen van een tray, bijvoorbeeld een tray volgens één van de conclusies 1-26 en 31-38, waarbij de tray ten minste één kom omvat en bij voorkeur ten minste één rij kommen omvat, waarbij een pulp moulding process (pulpvormproces) wordt toegepast, met het kenmerk dat de tray met behulp van het zogenoemde pulp moulding process wordt gevormd met komsecties van elke kom in een eerste toestand, waarbij in de eerste toestand binnenzijden van de respectievelijke komsecties van
elkaar vandaan zijn geplaatst, waarbij na het vormen de komsecties van elke kom versteld kunnen worden van de eerste toestand naar een tweede toestand voor het omsluiten van een binnenruimte van de respectievelijke kom.

40. Werkwijze volgens conclusie 39, waarbij een mal wordt gebruikt die is ingericht om alle komsecties van elke kom in hun eerste toestand te vormen.

41. Werkwijze volgens conclusie 39 of 40, waarbij de tray is voorzien van vouwsecties, voor het onderling naar elkaar toe vouwen van de komsecties.

42. Werkwijze volgens één van de conclusie 39-41, waarbij de tray is voorzien van vergrendelstructuren voor het aan elkaar vergrendelen van de komsecties wanneer zij in hun tweede toestand verkeren.
Fig. 6

1. Providing plant tray

2. Placing the cup on the ground
### SAMENWERKINGSVERDRAG (PCT)

**RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE**

<table>
<thead>
<tr>
<th>IDENTIFICATIE VAN DE NATIONALE AANVRAGE</th>
<th>KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P94953/NL00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nederlands aanvraag nr.</th>
<th>Indieningsdatum</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007198</td>
<td>29-07-2011</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aanvrager (Naam)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Holding P.M.M. Hoff B.V.</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Datum van het verzoek voor een onderzoek van internationaal type</th>
<th>Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-11-2011</td>
<td>SN57180</td>
</tr>
</tbody>
</table>

#### I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

**A01G9/10**

#### II. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK

<table>
<thead>
<tr>
<th>Onderzochte minimumdocumentatie</th>
<th>Classificatiesysteem</th>
<th>Classificatiesymbolen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IPC</td>
<td>A01G</td>
</tr>
</tbody>
</table>

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

#### III. GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES

(opmerkingen op aanvullingsblad)

#### IV. GEBREK AAN EENHEID VAN UITVINDING

(opmerkingen op aanvullingsblad)

Form PCT/ISA 201 A (11/2000)
ONDERZOEKSRAPPORT BETREFFENDE HET
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de
stand van de techniek
NL 2007/198

A. CLASSIFICATIE VAN HET ONDERWERP
INV. A01G9/10
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOEKDE GEBIEDEN VAN DE TECHNIEK
Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
A01G

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijds het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, WPI Data

C. VAN BELANG GEACHTDE DOCUMENTEN

<table>
<thead>
<tr>
<th>Categorie</th>
<th>Geachte documenten, eventueel met aanduiding van speciaal van belang zijnde passages</th>
<th>Van belang voor conclusie nr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EENHEID VAN UITVINDING ONTBREEKT</td>
<td>zie aanvullingsblad B</td>
<td>1-30</td>
</tr>
<tr>
<td></td>
<td>WO 2010/103276 A1 (COOLEY JOHN NEWSOME [GB]) 16 september 2010 (2010-09-16) * samenvatting; figuren 1,2,9 *</td>
<td>1-17,25</td>
</tr>
<tr>
<td></td>
<td>* bladzijde 2, regel 11 - regel 21 *</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>WO 2010/052472 A1 (COOLEY JOHN NEWSOME [GB]) 14 mei 2010 (2010-05-14)</td>
<td>1-12,</td>
</tr>
<tr>
<td></td>
<td>* samenvatting; figuren 1-6 *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>----</td>
<td></td>
</tr>
</tbody>
</table>

X Verdere documenten worden vermeld in het vervolg van vak C.

Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

* Speciale categorieën van aangehaalde documenten

*A* niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

*D* in de octrooiaanvraag vermeld

*E* eerdere octrooiaanvragen, gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

*L* om andere redenen vermelde literatuur

*O* niet-schriftelijke stand van de techniek

*P* tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltrokken
27 april 2012

Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type

Naam en adres van de instantie
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

De bevoegde ambtenaar
Dagnelies, Joëlle

Formulier PCT/ISA/501 (tweede blad) (Januari 2004)

bladzijde 1 van 2
<table>
<thead>
<tr>
<th>Categorie</th>
<th>Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages</th>
<th>Van belang voor conclusie nr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>GB 1 535 974 A (SPENCER H)</td>
<td>1-3, 9-16, 19-23,26</td>
</tr>
<tr>
<td></td>
<td>13 december 1978 (1978-12-13)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* bladzijde 4, regel 124 - bladzijde 5, regel 55; figuren 1-6 *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* alineas [0002], [0007], [0011], [0013], [0024]; figuren 1-5 *</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>US 6 161 331 A (LALANE RENEE [US])</td>
<td>19-21, 23-25</td>
</tr>
<tr>
<td></td>
<td>19 december 2000 (2000-12-19)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* samenvatting; figuren 1-8 *</td>
<td></td>
</tr>
</tbody>
</table>
De instantie belast met het uitvoeren van het onderzoek naar de stand van de techniek heeft vastgesteld dat deze aanvraag meerdere uitvindingen bevat, te weten:

1. conclusies: 1-30
   plant tray with spacer and method of planting a plant
   ---

2. conclusies: 31-42
   tray manufactured by pulp moulding and presenting a flat state for storage and an assembled state for use, and method of manufacturing a tray
   ---

Het vooronderzoek werd tot het eerste onderwerp beperkt.

Number of invention
It is considered that there are 2 inventions, covered by the following groups of claims:
Group 1: Independent claims 1 and 27 and dependent claims 2-26 and 28-30: A plant tray with a spacer for air-pruning and a method of planting a plant.
The definitions of the different (groups of) claimed inventions are only intended to identify said inventions in a concise manner. They may well, as such, comprise terms or generalisations which upon a close analysis could be found to extend the defined subject-matter beyond the contents of the applications as filed.
Reasoning
The reasons for which the inventions are not so linked as to form a single general inventive concept, are as follows:
The prior art has been identified as EP 1 741 332 A1 (D1) and discloses a plant tray (1) for propagating plants ([0001]), comprising a cup (3) for retaining a plant growing medium ([0025]) and a seed, a cutting and/or a plant at least partly embedded in the plant growing medium ([0025]), the cup (3) having a bottom structure (5) that is penetrable for a plant root growing in a downward direction (through apertures 7); and a method of planting a plant, in the tray ([0025]).
Hence, the special technical features of the first group of claims, which are intended to be a contribution over this prior art, i.e. the spacer and the step of placing the cup on the ground while planting, apparently solve the problem of avoiding that the plants primary roots grow upwardly in the cup and/or break during transport of the tray or when the plant is taken out the cup.
The special technical features of the second group of claims, which are intended to be a contribution over said prior art, i.e. the two states of the tray - flat and assembled - and the step of manufacturing the tray in the flat state, apparently solve the problem of finding a way to improve storage and ease the manufacture of the trays.
No same or similar special technical features can be determined and
different underlying problems are solved. Moreover, it is clear that the 2 claimed inventions can be applied independently of each other, i.e. they are not necessarily inter-related. It appears therefore that no technical relationship between the various claimed inventions exists involving one or more of the same or corresponding special technical features, beside the common and already well known feature of a tray, see document D1.

Conclusion
In conclusion, the groups of claims are not linked by common or corresponding special technical features and define 2 different inventions not linked by a single general inventive concept. The application, hence does not meet the requirements of unity of invention.
<table>
<thead>
<tr>
<th>In het rapport genoemd octrooigeschrift</th>
<th>Datum van publicatie</th>
<th>Overeenkomend(e) gescrtiften</th>
<th>Datum van publicatie</th>
</tr>
</thead>
<tbody>
<tr>
<td>WO 2010103276 A1</td>
<td>16-09-2010</td>
<td>GEEN</td>
<td></td>
</tr>
<tr>
<td>WO 2010052472 A1</td>
<td>14-05-2010</td>
<td>GEEN</td>
<td></td>
</tr>
<tr>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
<td>AU 514176 B2</td>
<td>29-01-1981</td>
</tr>
<tr>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
<td>AU 2421277 A</td>
<td>19-10-1978</td>
</tr>
<tr>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
<td>AU 6495980 A</td>
<td>16-04-1981</td>
</tr>
<tr>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
<td>CA 989614 A1</td>
<td>25-05-1976</td>
</tr>
<tr>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
<td>DE 2625498 A1</td>
<td>15-12-1977</td>
</tr>
<tr>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
</tr>
<tr>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
<td>HK 46279 A</td>
<td>13-07-1979</td>
</tr>
<tr>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
<td>KE 2977 A</td>
<td>20-07-1979</td>
</tr>
<tr>
<td>GB 1535974 A</td>
<td>13-12-1978</td>
<td>MY 8000062 A</td>
<td>31-12-1980</td>
</tr>
<tr>
<td>US 2010025347 A1</td>
<td>04-02-2010</td>
<td>GEEN</td>
<td></td>
</tr>
<tr>
<td>US 6161331 A</td>
<td>19-12-2000</td>
<td>GEEN</td>
<td></td>
</tr>
</tbody>
</table>
WRITTEN OPINION

File No. SN57180
Filing date (day/month/year) 29.07.2011
Priority date (day/month/year) 
Application No. NL2007198

International Patent Classification (IPC) INV. A01G9/10

Applicant Holding P.M.M. Hoff B.V.

This opinion contains indications relating to the following items:

☑ Box No. I Basis of the opinion
☑ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☑ Box No. IV Lack of unity of invention
☑ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐ Box No. VI Certain documents cited
☐ Box No. VII Certain defects in the application
☐ Box No. VIII Certain observations on the application

Examiner
Dagnelies, Joëlle

Form NL237A (Dekblad) (July 2006)
Box No. 1  Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any nucleotide and/or amino acid sequence disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:
   a. type of material:
      ☐ a sequence listing
      ☐ table(s) related to the sequence listing
   b. format of material:
      ☐ on paper
      ☐ in electronic form
   c. time of filing/furnishing:
      ☐ contained in the application as filed.
      ☐ filed together with the application in electronic form.
      ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:
Box No. III  Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step, or to be industrially applicable have not been examined in respect of

☐ the entire application
☒ claims Nos. 31-42

because:

☐ the said application, or the said claims Nos. relate to the following subject matter which does not require a search (specify):

☐ the description, claims or drawings (indicate particular elements below) or said claims Nos. are so unclear that no meaningful opinion could be formed (specify):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed (specify):

☒ no search report has been established for the whole application or for said claims Nos. 31-42

☐ a meaningful opinion could not be formed as the sequence listing was either not available, or was not furnished in the international format (WIPO ST25).

☐ a meaningful opinion could not be formed without the tables related to the sequence listings; or such tables were not available in electronic form.

☐ See Supplemental Box for further details.

Box No. IV  Lack of unity of invention

1. The requirement of unity of invention is not complied with for the following reasons:

   see separate sheet

2. This report has been established in respect of the following parts of the application:

☐ all parts.
☒ the parts relating to claims Nos. (see Search Report)
<table>
<thead>
<tr>
<th>Statement</th>
<th>Yes: Claims</th>
<th>No: Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novelty</td>
<td>6, 8, 13, 17, 21, 24</td>
<td>1-5, 7, 9-12, 14-16, 18-20, 22, 23, 25-30</td>
</tr>
<tr>
<td>Inventive step</td>
<td>24</td>
<td>1-23, 25-30</td>
</tr>
<tr>
<td>Industrial applicability</td>
<td>1-30</td>
<td></td>
</tr>
</tbody>
</table>

2. Citations and explanations

see separate sheet
Re Item IV Lack of unity of invention

1 Number of inventions: 2

It is considered that there are 2 inventions, covered by the following groups of claims:

Group 1: Independent claims 1 and 27 and dependent claims 2-26 and 28-30: A plant tray with a spacer for air-pruning and a method of planting a plant.


The definitions of the different (groups of) claimed inventions are only intended to identify said inventions in a concise manner. They may well, as such, comprise terms or generalisations which upon a close analysis could be found to extend the defined subject-matter beyond the contents of the applications as filed.

2 Reasoning

The reasons for which the inventions are not so linked as to form a single general inventive concept, are as follows:

2.1 The prior art has been identified as EP 1 741 332 A1 (D1) and discloses a plant tray (1) for propagating plants ([(0001)], comprising a cup (3) for retaining a plant growing medium ([(0025)]) and a seed, a cutting and/or a plant at least partly embedded in the plant growing medium ([(0025)]), the cup (3) having a bottom structure (5) that is penetrable for a plant root growing in a downward direction (through apertures 7); and a method of planting a plant, in the tray ([(0025)]).

2.2 Hence, the special technical features of the first group of claims, which are intended to be a contribution over this prior art, i.e. the spacer and the step of placing the cup on the ground while planting, apparently solve the problem of avoiding that the plants primary roots grow upwardly in the cup and/or break during transport of the tray or when the plant is taken out the cup.

The special technical features of the second group of claims, which are intended to be a contribution over said prior art, i.e. the two states of the tray - flat and assembled - and the step of manufacturing the tray in the flat state, apparently solve the problem of finding a way to improve storage and ease the manufacture of the trays.
2.3 No same or similar special technical features can be determined and different underlying problems are solved. Moreover, it is clear that the 2 claimed inventions can be applied independently of each other, i.e. they are not necessarily inter-related.

It appears therefore that no technical relationship between the various claimed inventions exists involving one or more of the same or corresponding special technical features, beside the common and already well known feature of a tray, see document D1.

3 Conclusion

3.1 In conclusion, the groups of claims are not linked by common or corresponding special technical features and define 2 different inventions not linked by a single general inventive concept.

The application, hence does not meet the requirements of unity of invention.

3.2 As no search has been established for the second invention, the present examination with regard to novelty and inventive step concerns the claims of the first invention only, i.e. claims 1-30.

Re Item V Novelty, inventive step; citations and explanations

4 Reference is made to the following documents:

D2 WO 2010/103276 A1 (COOLEY JOHN NEWSOME [GB]) 16 september 2010 (2010-09-16)

D3 WO 2010/052472 A1 (COOLEY JOHN NEWSOME [GB]) 14 mei 2010 (2010-05-14)

D4 GB 1 535 974 A (SPENCER H) 13 december 1978 (1978-12-13)


5 The present application does not meet the criteria of patentability, because the subject-matter of claim 1 is not new.

5.1 Document D2 discloses (the references in parentheses applying to this document):

A plant tray (2) for propagating plants (p. 1 l. 4-5), comprising a cup (8) for retaining a plant growing medium (p.3 l.22-24) and a seed, a cutting and/or a plant at least partly embedded in the plant growing medium (implicit: for
propagating plants, the plant tray of D1 must contain a seed, a cutting or a plant at least partly embedded in the plant growing medium), the cup (8) having a bottom structure (16) that is penetrable for a plant root growing in a downward direction (see Fig.2: hole in the bottom structure 16), wherein the tray (2) further comprises a spacer (consisting of the two legs 18) extending downwardly, beyond the bottom structure (16) of the cup (8) (see Fig.2).

The subject-matter of claim 1 is therefore disclosed in D2.

5.2 Likewise, the subject-matter of claim 1 is disclosed in document D3, with tray 2, cups 6 and spacer defined by four legs 24 or D4, with tray 1, cups 11, bottom apertures 22, 30 and spacer 23.

6 Dependent claims 2-23, 25, 26 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step. The reasons are the following:

- claims 2-5, 7, 9-12, 14-16, 18-20, 22, 23, 25 describe several additional features which are disclosed in D2, D3 or D4:
  - cl.2: legs 18 in D2, Fig.2 in D3;
  - cl.3: see Fig.2, chamber between the two legs in D2, Fig.2 of D3;
  - cl.4, cl.5, cl.7: apertures between the ribs 14 in D2, openings 14 in D3;
  - cl.9: see aperture in bottom 16 in Fig.1 and Fig.2 of D2; p.11 paragraph in the middle of D3;
  - cl.10: Fig.1;
  - cl.11: implicit in view of Fig.1 of D2, Fig.3 of D3;
  - cl.12: Fig.2 of D3;
  - cl. 14, cl. 15: the compost filled in the cups of D2 or D3 is a biodegradable material and a body including plant nutrition material;
  - cl.16: see Fig.1 in D2 or D3;
  - cl.18: the cups 6 are connected to each other via the tray 2 but can be removed from the tray in D3;
  - cl.19, cl.22, cl.23: see Fig.2 and Fig.5 in D4;
  - cl.20: p.3 l.124-129 in D4;
  - cl.25: see Fig.9 in D2;
  - cl.26: Fig.2 in D4, suggested in D3 in Fig.1 and p.3 third paragraph;
- claims 6, 8, 13, 17, 21 describe several additional features which represent minor constructional changes of the tray of D2, D3 or D4 that the skilled person would select, if the circumstances require it, without exercising his inventive skills.

7 The present application does not meet the criteria of patentability, because the subject-matter of claim 27 is not new.

Document D5 discloses (the references in parentheses applying to this document):

A method of planting a plant ([0002], [0013]), comprising the steps of:
- providing a plant tray comprising biodegradable material ([0011]), the tray including a cup ("pot") retaining a plant growing medium and a plant embedded in said medium (implicit in view of [0011] and [0007]), and
- placing the cup on the ground ([0024]; in a planting hole, there is ground underneath the cup).

8 Dependent claims 28-30 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of novelty (see Fig.5 and [0024] of D5).

9 The combination of the features of dependent claim 24 seems neither known from, nor rendered obvious by, the available prior art.