German utility model no. DE202023105934U1

Device for Increasing Crop Yields in Agricultural Plants

Description

Given the rapidly growing global population, alternative food and farming methods are becoming increasingly important. For example, algae or bacteria can produce essential nutrients very quickly. However, the acceptance of these or other foods (such as insects) is still quite low in many countries.

Since humans began cultivating plants, there has been an effort to increase yields. Initially, this was done by selecting and propagating high-yielding plants, and later, by crossing them to combine desired traits. However, this could not be done in a targeted manner. Even much later, new crops were modified using ionizing radiation or chemicals to achieve improved properties, but these changes were also not targeted. New methods include smart breeding (precision breeding), in-vitro culture (propagation of genetically identical plants or other organisms), viral infection, and more recently, the alteration of plant DNA using genetic engineering methods such as CRISPR-Cas.

Components of agricultural plants include, for example, the shoot axis, which connects the leaf with the root for nutrient supply. In this invention, the shoot axis is omitted. The primary focus for yield is on the fruit, vegetable, grain, etc. (e.g., seeds and fruit walls, edible plant parts), which usually form after the flower is fertilized. There are also examples of fruits that develop without fertilization of the ovules. Wheat grains can also develop from a plant embryo.

In this context, it is important to note that an entirely new plant can develop from a single plant cell. Varieties that produce high yields often cannot be crossed with other cultivated plants due to genetic differences, except through specialized methods. The present invention does not aim to create even more high-yielding varieties, but rather to increase crop yields using devices/machines that optimize the use of existing varieties.

Heat, drought, or flooding are increasingly causing severe crop losses worldwide. Therefore, it is worth considering whether intensive cultivation in greenhouses, using these devices, "urban farming"/"vertical farming," or even in basements, can partially take over food production, allowing fields to return to nature. Plants already grow without soil, with their roots immersed in water/nutrient solutions and/or sprayed with them. A step further would be not to grow whole plants but only the grain, fruit, or vegetable. Thus, this invention is useful for more effectively producing conventional foods such as grains, rice, vegetables, and fruits.

Therefore, my invention is based on the further development of existing devices and cultivation methods. There are historical and current solutions related to this invention, such as:

- DE000060010502T2: Metabolites from plants are obtained in soilless culture.
- JP000H08172910A: Cut flowers are supplied separately with liquid.
- CN000106688864A: System with lamp, misting, and nutrient solution for grain seed.
- CN000115462254A: Automated plant rearing system including lighting.
- CN000203027859U: Automated system for plant watering.
- US000007877928B2: Mass production of potato seedlings by collecting vegetative points in a liquid or solid culture.

The existing solutions fulfill their respective functions (or are still in development or have been abandoned) but do not have the capabilities of the above-mentioned invention.

A universally installable solution is desired. The invention specified in claim 1 for a device to increase crop yields in agricultural plants through a combination of various techniques, such as (green) genetic engineering, (micro) mechanics, pumps, computer control, sensors, lighting technology, environmental technology for temperature, humidity, and possibly air movement, meets these requirements.

Examples of Implementation

As shown in claim 2, mini-robots, for example, (semi-)automatically connect reusable connectors 1 directly to the stems of grains, vegetables, or fruits 3. These connectors are optionally compostable or recyclable. Connecting can, of course, also be done manually, possibly with aids/devices/tools. If fertilization/pollination is necessary, it can be done naturally or also automated through devices.

Very high crop yields could be generated with significantly less energy through the direct supply of nutrients. This also benefits the environment, as this cultivation of crops can be space-saving, without pesticides and other plant protection products, and thus environmentally friendly. Without fertilization/manure on fields, groundwater is also relieved, among other things.

Using molecular genetic machines for (green) genetic engineering (including genome editing, "genome surgery"), as outlined in claim 3, makes the invention possible and/or particularly effective. Molecular genetic machines enable, for example, the inactivation or activation of genes (methylation, demethylation, or other genetic "switches"), targeted mutations (including point mutations, changes of a single base), destruction of genes, targeted insertion of DNA, among others, using CRISPR-Cas, Fanzor gene scissors (molecular biological/molecular genetic methods), etc.

As illustrated in claim 4, depending on the crop/plant, an "individual" or "mass connector" is practical (Fig. 1, Fig. 2). Depending on the plant, it may also be advantageous according to claim 5 to simply dip the stem in a nutrient solution 5 with devices (Fig. 3).

The "mass connector" is particularly effective (Fig. 2): many stems of fruits/grains/vegetables are supplied with the nutrient solution, for example, via a (flat) pad/cushion/sponge/container 4 that is sealed at the edges.

As described in claim 6, higher pressure/high pressure of the nutrient solution or the application of an electric voltage (e.g., through electro-osmosis, with, for example, a wire mesh over the plants) on the stem can ensure faster growth.

According to claim 7, optimized crop yields of agricultural plants through devices, among others, in greenhouses, "urban farming"/"vertical farming," halls, high-rise buildings, at home in living rooms or basements (also enclosed devices that, for example, are the size of refrigerators), in intensive greenhouses/containers in the garden, etc., are possible. Naturally, the special cultivation of parts of the crops is also possible in fields without LEDs, with natural sunlight (possibly with devices for protection against animal feeding and in combination with photovoltaics).

As illustrated in claim 8, all environmental variables/conditions should be regulated by computer control and monitored with sensors: for example, optimized lighting by LEDs (depending on the crop, also with different wavelengths, humidity, etc.). For ground crops like potatoes, carrots, onions, etc., the use of LEDs is, of course, unnecessary. According to claim 9, pumps, electric motors/machines, computers, sensors, devices for optimized temperature (heating/cooling), and possibly wind through fans and humidity are used in this context.

As described in claim 10, sensor-controlled machines optimize the nutrients/sugar solution/nutrient solution, including the concentration and pressure of the solution, depending on the crop (fruit, grain, vegetable, etc.) and adjust to the growth phases/development stage.

From individual plant cells, according to claim 11 (if necessary), the various plant components can be generated using molecular genetic machines, among other methods. The vegetative points/growth points can be stimulated using devices (bio)chemically, physically, genetically, or even mechanically, if necessary. As illustrated in claim 12, harvesting can be done manually based on visual inspection or image analysis, or by robots.

Alternatively, according to claim 13, mini-robots can pick many young fruits/grains, etc., with stems and continue cultivating them with the aforementioned devices. Trees, shrubs, crops, etc., can also be stimulated to produce a large number of unripe fruits (or fertilized flowers) with stems using devices.

Since cultivation occurs in a low-germ/sterile environment, as described in claim 14, devices for mechanical or non-mechanical cleaning of the connectors/stems, etc., due to a biofilm/bacteria/fungi, etc., can largely be omitted.

Thus, it is possible to cultivate almost all fruits/vegetables/grains, etc., such as potatoes, other ground crops, wheat, rice, corn, asparagus, apples, oranges, tomatoes, cucumbers, cabbage, etc.

In summary, local production of crops/fruits/grains/vegetables saves energy. It is not necessary to "nourish" a complete plant. With adjusted environmental variables through temperature, humidity control, etc., food can be harvested that would otherwise have to be imported from distant countries. This would save even more energy and resources.

Reference List

(1) Connector/connection between nutrient line and stem/plant part

(2) Nutrient line

(3) Fruit/grain/vegetable, etc.

(4) Nutrient-containing pad/cushion/sponge/container

(5) Nutrient solution

Claims

1. Device for Increasing Crop Yields in Agricultural Plants,
characterized in that
a combination of different techniques such as (green) genetic engineering, (micro) mechanics, pumps, computer control, sensors, lighting technology, environmental technology for temperature, humidity, possibly air movement, etc., is used for construction.

2. Device for Increasing Crop Yields in Agricultural Plants, according to claim 1,
characterized in that
mini-robots (semi-)automatically attach connectors 1 directly to the stems of grains, vegetables, or fruits 3. The connection can also be made manually, possibly with aids/devices/tools. Similar devices are also used for fertilization/pollination if this does not occur naturally.

3. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
molecular genetic machines implement (green) genetic engineering (including genome editing, "genome surgery"): e.g., inactivation or activation of genes (methylation, demethylation, or other genetic "switches"), targeted mutations (including point mutations, changing a single base), gene destruction, targeted insertion of DNA using CRISPR-Cas, Fanzor gene scissors (molecular biological/molecular genetic methods), etc.

4. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
depending on the crop/plant, an "individual" or "mass connector" is constructed (Fig. 1, Fig. 2).

5. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that

depending on the crop, the stem is dipped/held in the nutrient solution 5 with devices (Fig. 3). With the "mass connector" (Fig. 2), many stems of fruits/grains/vegetables are attached to a nutrient-containing pad/cushion/sponge/container 4, which is sealed at the edges.

6. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
a higher pressure/high pressure of the nutrient solution is applied to the stems and/or an electric voltage is applied (e.g., by electro-osmosis, with a wire mesh over the plants).

7. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
the constructions with devices are installed in greenhouses, "urban farming"/"vertical farming," halls, on high-rise buildings, at home in living rooms or basements (also enclosed devices that are, for example, the size of refrigerators), in intensive greenhouses/containers in the garden, etc. In fields, the construction is possible without LEDs and natural sunlight (possibly with devices for protection against animal feeding and in combination with photovoltaics).

8. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
all environmental variables/conditions are controlled with sensors and regulated by computer control: e.g., optimized lighting by LEDs (for crops that need lighting, depending on the crop and growth phase, also with different wavelengths, humidity, etc.).

9. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
pumps, electric motors/machines, sensors, computers, devices for optimized temperature (heating/cooling), lighting fixtures, and possibly fans are installed in the construction.

10. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
sensor-controlled machines optimize the nutrients/sugar solution/nutrient solution, including the concentration and pressure of the solution, depending on the crop (fruit, grain, vegetable, etc.), and adjust to the growth phases/development stage.

11. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
using molecular genetic machines (if necessary), the various and necessary plant components are generated from individual plant cells. The vegetative points/growth points may be stimulated using devices (bio)chemically, physically, genetically, or mechanically.

12. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
the harvest is carried out manually or by machines/robots based on visual inspection or image analysis.

13. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
mini-robots pick many young/growing fruits/grains/vegetables, etc., with stems and continue cultivating them with the devices of the invention. Trees/shrubs/crops, etc., can also be stimulated to produce a large number of unripe fruits (or fertilized flowers) with stems using devices.

14. Device for Increasing Crop Yields in Agricultural Plants, according to one of the preceding claims,
characterized in that
devices carry out mechanical or non-mechanical cleaning of the connectors/stems, etc., as needed.

Fig. 1

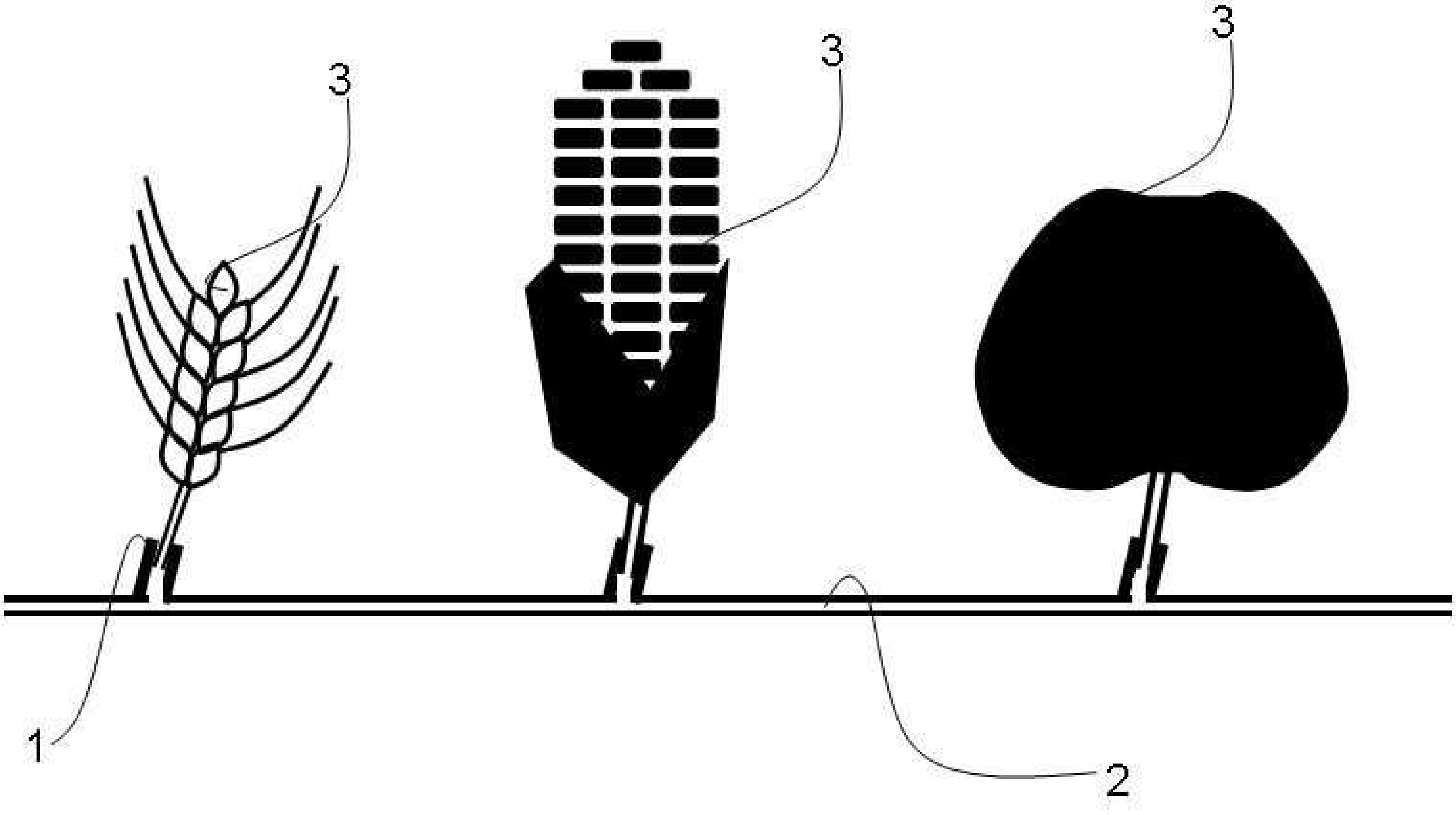

Fig. 2

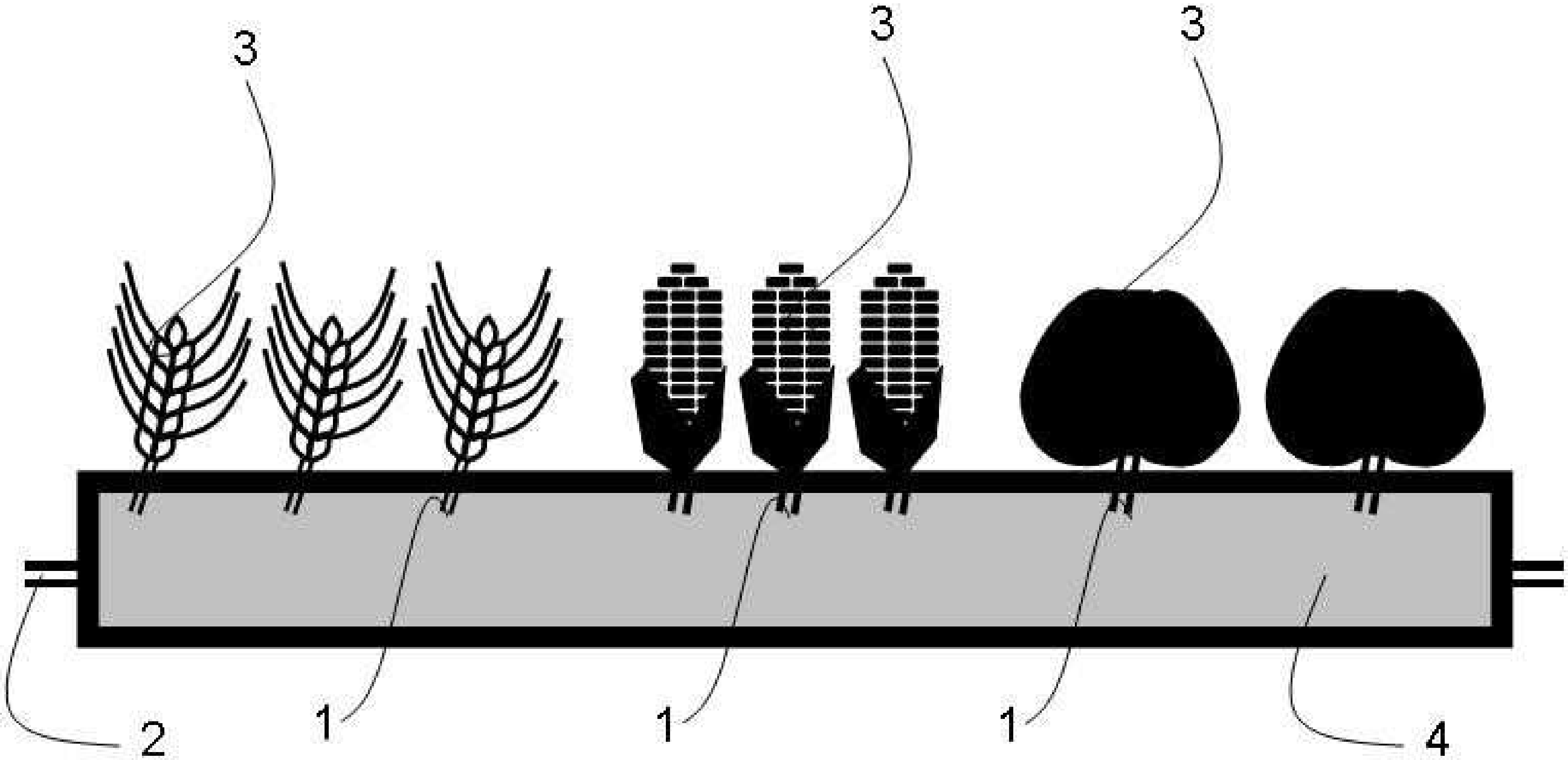

Fig. 3