

Description

Full-automatic Parallel-moving Tray Type Organic plants Growing System

I. Field of the Invention: The invention belongs to the field of agricultural growing, and particularly relates to artificial soil cultivation medium and use method in the scope of growing of organic plants in facility agriculture and gardening facilities.

II. Operation Method of the Invention: Synthetic organic nutrition soil specialized for newly grown organic plants (hereinafter referred to as material for growing) or materials used for previously grown plants after being grown for one period are screened by an automatic screening machine to remove such sundries as roots, abandoned plants leaves and the like, the material for growing are prepared according to a formulation of the material for growing, fed into an automatic stirring and batching system to stir uniformly, and then fed into an automatic disinfection system. The material for growing after being automatically disinfected are fed into an automatic loading system, wherein the system may automatically load the material for growing after being disinfected into a 2m x 1m stainless steel growing tray. The material for growing after being loaded are fed into an automatic sowing system, and an automatic sower sets row and line spacing according to demands of growing different plants and sows automatically. The tray after being automatically sown with the plants is fed into an automatic parallel-moving growing area, wherein the best area of the growing area of the system is 10000 square meters. Such as according to our present growing experience, the growing period of leafy vegetables is generally 25 days. Therefore, the growing area is designed into a 200m x 50m square matrix. The growing tray moves forward for 1m in every 12 hours in the growing area. A fixed water curtain is utilized to realize uniform watering during moving forward, and the watering density is controlled through the traveling speed of the tray. 50 growing trays are arranged in each line (the direction of forward motion of the tray) and one sown growing tray is fed in every 12 hours, and meanwhile a tray for mature vegetables is delivered to an automatic picking system. At the same time, a watering program is finished. The tray for the mature vegetables is automatically delivered from the other side and fed into a conveying system. The conveying system conveys the tray to an automatic picking and packaging system. An automatic picking robot finishes picking, sorting and packaging, and the packaged vegetables are directly conveyed to a refrigerating chamber for being conveyed to a sales company.

Device Arrangement: The devices of the A, B, C, D and E automatic systems are all arranged in a second layer device platform having one side that is 3m in width and 2m in height for feeding the tray in the growing system, and the devices of the G and H automatic systems are arranged at one side of delivering the plants tray out of the growing system after the plants are mature.

Main Applications: The system is mainly applied to cultivation of organic plants in greenhouse facility agriculture, and has the best effects when being applied to cultivate organic vegetables, organic melons and fruits, organic tobaccos and organic crude medicines.

Advantages of the Growing System: The growing system upgraded from the original semi-enclosed slot type organic plants growing system previously invented by inventor, realizes full automation growing of organic vegetables and other organic plants, which is one revolution in the organic growing industry, and completely realizes automation, quantification and standardization of organic growing; greatly improves the land use capability, saves the non-effective land area occupied for manufacturing a growing slot, and increases the land use capability of the previous semi-enclosed slot type growing method from 60-70% to 90% above. Damage by disease and insect can be completely eliminated due to an automatic artificial organic nutrition soil disinfection system arranged and the effect of the enclosed type growing greenhouse for isolating the damage by disease and insect; and this is also breakout of the growing industry in extermination of disease and insect, which greatly reduces involvement of plants protection products that are allowed to be used in growing organic plants, effectively prevents the occurrence and spreading of the damage by disease and insect, and guarantees the purity of the organic products. Comparing the system with the semi-enclosed slot type growing system, the manual work is greatly reduced, wherein the manual work used by the system is only 10% of that of the ordinary semi-enclosed growing method. A 10000 square meter growing system only requires 2 workers to

operate.

III: Background of the Invention: An artificial soil cultivation technology is a technology that has great popularization value in crop growing, and may be widely applied with the gradually reduced arable lands and continuously increased requirements of people on the nutrient components, quality and safety of the crops. In lots of advanced countries in the world currently, the technology is developed very fast and is widely applied as a good-quality high-yield production manner for such crops as vegetables, particularly in growing organic vegetables, and occupies a quite high proportion in the area of facility agriculture. This is because that synthetic soil cultivation serving as an innovative and high technology in the development of modern agriculture not only has the characteristics of fertilizer, water and labor power saving, stable and high yields, convenience in implementing standardization management and satisfied green and organic demands, but also has the characteristics of being free from environment and geographic restrictions and being capable of effectively overcoming various obstructions and preventing the underground damage by disease and insect from being spread. For example, China has a certain foundation on application of this aspect. Research divisions represented by Chinese Academy of Agricultural Sciences have already studied practical artificial soil cultivation system and method that are suitable for Chinese situations, comply with the sustainable development requirements on organic agriculture and agriculture, and have remarkable economic, social and ecological effects, replace the traditional high-cost big-difficulty and non-environmental friendly chemical nutrient solution soilless cultivation method by an organic solid fertilizer method, obtain satisfying effects, and are spread to enter the orbit of organic agriculture gradually. On this occasion, the grown crops only require fresh water and fine organic fertilizer during the entire process of growth, so that the restriction of required chemical nutrient solution for soilless cultivation is successfully broken through, which reduces the disposable investment by more than 50% and reduces the fertilizer cost by more than 70% than that of the previous simplest nutrient solution slot cultivation method. Moreover, the operation and management procedures are greatly simplified, and the method may be gradually incorporated into "standardization" management. However, as indicated in the relevant data, substances used in the foregoing organic solid fertilizer method are selected from corn stalks, sawdust, mushroom residues, slag, and such coarse soil with fiber as river carbon. Although the substances are cheap abandoned resources that can be continuously regenerated in an ecological system, the substances serving as fertilizer solution carriers, occupy most volumes so that the fertilizer storage volumes thereof are gradually reduced. In addition, because most the fertilizers used are from puffed chicken manure and impure sheep manure, the fertilizer efficiency and the nutrition categories, contents and quality of the nutritional crops are much poorer than that of the pure sheep barnyard manure and cow manure. Therefore, with respect to the foregoing situations and with reference to the prior art, the invention firstly uses pure sheep barnyard manure as the main raw material and uses pure cow manure as auxiliary material to manufacture artificial soil mixture, and refine the soil mixture into a soil and fertilizer source integrated solid artificial soil and use method which are not only suitable for growing plants, but also is simple to manage and operate via unceasing experiments. Currently, the technology is matured, and is an advanced and practical agricultural technology achievement that has great promotion value. Experiments show that the invention has multiple advantages than various existing soilless cultivation technologies, and has more advancement and uniqueness in the aspect of promoting organic and green production particularly. Pollution-free seed-carrying soil and organic fertilizer resources are required to develop organic agriculture. Currently, the solid organic fertilizer used in soilless cultivation are from different sources, which have more uncertain factors, and cannot measure and select the nutrient components and harmful matter contents thereof via science data and standardization, and also is impossible to defect each component. Therefore, it is difficult to uniform the standard during the process of mixing and matching the artificial soil and fertilizers, which has larger randomness and can only be operated by experience and feeling, thus causing larger quality differences to products produced in this manner. Particularly, a certain amount of chemical nutrient solution is required during the entire growing process of the plants due to the heterogeneity of raw material resources thereof, uncertainty of various components included, probability of harmful matters included, incompetence of nutrient components therein and insufficient fertilizers. Therefore, general artificial soil cultivation technologies used currently and selected artificial soil are not normative, and an artificial soil cultivation standard system in true sense is not formed. Therefore, the artificial soil form and use method can only be used in a small range of local area, and the products thereof

cannot be determined on the same level standard naturally, much less for using the method to produce organic food. While further perfection and improvement are required for implementing scale, standardization and factorization production.

Therefore, the inventor previously invented the "semi-enclosed slot type artificial organic nutrition soil growing method for organic plants", which was applied a patent in Singapore on December 26, 2013, under the name of "MANUFACTURE AND USE AN ORGANIC NUTRITION SOIL FOR GROWING ORGANIC PLANTS", Singapore Patent Application No.201309584-9, Accorded No.201309584-9, Accorded a Date of Filing 26/12.2013. The invention aims at overcoming all the foregoing defects by providing a new-type artificial soil and use method. The soil is not only served as a hotbed and carrier for growing plants, but also is a nutrition storage library for growing plants. Moreover, the soil comprises stable components and comprehensive fertilizer categories, does not need additional fertilizers during the entire growing process, is a pollution-free full-nutrition, pure-natural, environment friendly and safe integrated solid organic fertilizer artificial soil, which complies with the use principle of the fertilizer for producing organic food, and has the organic, green, ecological and environment friendly characteristics. Meanwhile, compared with other soilless cultivation mediums, the artificial soil has the advantages of fertilizer, labor, water and time saving as well as fast growing, high yield and good quality of plants.

Based on the foregoing invention, although the semi-enclosed slot type growing method has successfully entered a large-area growing stage after growing experiments, damage by disease and insect cannot be eliminated due to lower land effective availability (60%-70%) of using the semi-enclosed growing slot. Therefore, during the process of growing organic plants, the probability of damage by disease and insect is higher. Moreover, because powerful insecticide cannot be used when growing the plants, the damage by disease and insect in case of large area outburst cannot be effectively controlled, which may possible cause large area production reduction. Furthermore, because the foregoing growing manner adopts labor operation whole through the growing process, the consumption of labor is too large, which causes higher product cost due to increasingly high manual labor rate.

Therefore: the invention namely "full-automatic parallel-moving tray type organic plants growing system" based on the foregoing invention enables the full automation, quantification and standardization of the growing process of organic plants. Because an effective grown material disinfection system is adopted, damage by soil-borne disease and insect can be completely and effectively prevented during the growing process, which develops a completely novel and effective method for growing organic plants on the aspect of plants protection, and is a major revolution in the field of organic growing. Because the entire system of the invention is completely automated, the consumption of labor is only 10%-20% of that of the semi-enclosed slot type organic nutrition soil method for growing organic plants, which greatly saves the labor cost, and plays a definitiveness role of reducing the total cost of the organic products.

IV: Summary of the Invention: According to the foregoing objectives, the full automation growing manner reflected by the "full-automatic parallel-moving tray type organic plants growing system" of the invention is realized through the following technical solution.

1. Selection of grown materials:

The growing system selects the artificial organic nutrition soil manufactured in the invention "MANUFACTURE AND USE AN ORGANIC NUTRITION SOIL FOR GROWING ORGANIC PLANTS" of the inventor as a material for growing. The material selection and manufacture method is as follows: (A) manufacture of main raw material fertilizer source and nutrient source:

selecting pure prairie sheep barnyard manure and cow manure according to a proportion of 80% sheep barnyard manure and 20% cow manure, mixing, grinding the manure, sufficiently fermenting and thoroughly decomposing, and air-drying the manure to make the grain size of the manure about 0.2mm-0.5mm and then bag the manure for convenient storage, conveying and use.

Simple manufacture method: Raw materials containing 80% sheep barnyard manure and 20% cow manure are sufficiently mixed, grinded and added with water to control the moisture of the raw materials at $55\% \pm 5\%$ so as to be beneficial for fermenting and thoroughly decomposing. Anaerobic zymophyte is uniformly mixed in

the raw materials and stacked on a ground paved with a plastic film or being hardened. The raw materials are stacked into a trapezoid square pile which is 3m in bottom width, 2m in top width, 2m in height and 20-30m in length, and the pile is completely covered by a plastic film, which is beneficial for using an anaerobic fermentation method to make the raw materials sufficiently fermented and decomposed. During the process of fermenting and decomposing, the temperature of the material can reach 70 DEG C, and an instantaneous temperature may reach 75 DEG C sometimes. The time of continuously reaching or exceeding 70 DEG C exceeds 24hours. After 45-day around sufficient fermenting and decomposing, when a finished product realizes scentless taste, no live worm ovum, no harmful bacteria, no activity in weed seeds, and goes black brown, the plastic film is opened to air-dry the finished product naturally. The decomposed main raw materials of the organic nutrition soil specialized for growing organic plants may be spread for quickening the air-drying speed. After air-drying, the moisture is less than or equal to 20%, the main raw materials of the organic nutrition soil specialized for growing organic plants are completely manufactured, and can be bagged and stored at this moment, so as to be conveniently conveyed and used.

The raw materials of the organic nutrition soil specialized for growing organic plants during factorization production is produced by adopting a fermenter having a turner through an aerobic fermentation method. Specific steps comprise: Raw materials containing 80% sheep barnyard manure and 20% cow manure are sufficiently mixed, grinded with the moisture at $55\% \pm 5$. Anaerobic zymophyte is added and then the raw materials are placed into a fermenter which is 4-8m in width (determined according to the specification of the turner), 2m in depth, and about 60m in length, wherein the fermenter is arranged in an oxygen-supply ventilation device which may quicken to ferment and decompose the raw materials. The raw materials are turned for once in every 48 hours. The temperature of the fermented raw materials can reach 70 DEG C, and an instantaneous temperature may reach 75 DEG C sometimes. The time of continuously reaching or exceeding 70 DEG C exceeds 24hours. After 2-3 weeks in this way, the materials may be completely fermented and decomposed. Because the time of continuously reaching or exceeding 70 DEG C exceeds 24hours, worm ovum, harmful bacteria and weed seeds in the raw materials may be completely killed or inactivated, thus achieving the objective of harmless treatment. When the fermented materials go black brown and have scentless taste, the materials are spread out on the hardened ground for air drying, and can be bagged and stored for conveying and using when the moisture of the materials is less than or equal to 20%.

(B) The main raw materials of the foregoing artificial organic nutrition soil specialized for growing organic plants are sufficiently and uniformly mixed with sand and natural peat according to a proportion of 10-50% raw material, 20-70% sand and 10-30% natural peat, to manufacture the artificial organic nutrition soil specialized for growing organic plants.

2. Application of the artificial organic nutrition soil in the system:

The inventor describes the foregoing artificial organic nutrition soil use method in details in AND USE AN ORGANIC NUTRITION SOIL FOR GROWING ORGANIC PLANTS", and describes the use of the artificial organic nutrition soil in a growing tray here. Firstly the prepared artificial organic nutrition soil is disinfected and the disinfected artificial organic nutrition soil is placed in growing trays having different depths according to differences of the grown plants. When using a tray to grow crops, the humidity and temperature of the artificial organic nutrition soil in the tray need to be accurately mastered. The humidity differs for different crops and is generally determined according to universal experience. To know the temperature and humidity of the artificial organic nutrition soil in the growing tray, an automatic hygrothermograph is arranged in the growing system to measure the temperature and humidity of the artificial organic nutrition soil in the growing tray. Moisture management is mainly adjusted according to the growth situation of the plants and the climatic changes. Rainy and cloudy days require no water or less water, while high temperature, very hot and gale days require much water. However, watering in the afternoon of the high temperature and very hot days; otherwise, the plants roots are easily short of oxygen so that the plants are atrophied and even dead.

Because the sheep barnyard manure and cow manure used in the artificial organic soil belong to slow release type total nutrient organic fertilizer, contents of effective nitrogen, phosphorus and potassium therein beneficial for growth of plants are high, and all secondary elements and microelements required for growth of plants are contained; when growing vegetables, the plants may absorb various required nutrition from the medium uniformly and continuously during the entire growing process. Till harvesting, other fine organic fertilizers are

not needed. The nutrition release and absorption principles reflected by the invention are similar to the nutrition absorption principle during liquid cultivation. The difference is that the liquid cultivation method adopts artificially and chemically composed nutrient substances and directly supplies the nutrient substances to the plants for absorption through the adjustment of water in a liquid state manner. Because the chemical fertilizers are used, the product produced cannot reach the standard of organic products. However, because the artificial organic nutrition soil used by us is both a carrier and a nutrient source, which releases nutrition through the resolution of water for the plants to absorb under the effects of temperature and photosynthesis, the nutrient substances are completely from pure natural organic fertilizers and materials, and thus the produced product may reach AAA grade organic product standard. However, this nutrition absorption manner needs to consider energy aggregation and cannot release excessive energy; that is, the plants are prevented from "death by burning" caused by excessively absorbing the nutrient substances. To reasonably and regularly release the nutrient substances in the artificial organic nutrition soil, the watering amount and watering time need to be controlled through greenhouse management, so as to control the temperature and humidity, so that the crops are growing normally in a proper temperature and humidity range.

3. Excluding all the advantages reflected by the invention "MANUFACTURE AND USE AN ORGANIC NUTRITION SOIL FOR GROWING ORGANIC PLANTS", the invention further has outstanding performances in the following advantages:

(A) Realize the full automation of the growing system, and innovate the organic growing method.

(B) Provide assurance for the quantification and standardization of nutrient management: Realize the quantification, standardization and normalization of fertilizing management for soilless cultivation, and make production of organic plants, particularly the production of organic vegetables take another major step towards the aspects of good quality, safety and high yield.

(C) Adopt an artificial organic nutrition soil effective disinfection system: Because a neutron generator and a high temperature steam dual system disinfection mode is adopted, all the harmful bacteria, ovum and other harmful viable tissues in the material for growing are completely eliminated, so that the damage by disease and insect is completely and effectively prevented, which reflects unique advantages in the aspects of controlling and preventing the damage by disease and insect, and is a major breakout in the aspects of protecting the plants and preventing the damage by disease and insect during large-area growing in organic agriculture.

(D) The parallel-moving tray type organic plants growing manner adopted is the first case internationally: Because the full-automatic parallel-moving tray type growing method is adopted, the productivity is greatly improved, which makes a big contribution for spreading the automatic growing of the organic plants in the whole world.

(E) The automatic growing system is free from geographic restrictions: the full-automatic growing system does not need to use local soil, and can grow organic vegetables under any environment, which provides an irreplaceable method for growing organic plants under remote and severe environments.

(F) Because a mobile tray type growing method is adopted: A simplified background platform is provided for realizing full-automatic picking of plants.

V. Detailed Description of the Preferred Embodiments

1. Construct greenhouses: The "full-automatic parallel-moving tray type organic plants growing system" is applied in greenhouse facilities; therefore, the greenhouses need to be constructed firstly. The greenhouses need to be constructed as multi-span greenhouses. According to the use area of the system, the area of a single multi-span greenhouse is 10000 square meters. Different greenhouses need to be constructed according to different areas. However, the objectives of all the greenhouses comprise: A, to isolate influences of external severe climates on the crops; B, to effectively control damage by disease and insect; and C, to isolate pollutions of artificial harmful matters such as pesticide on the crop quality.

2. Construct a full-automatic parallel-moving tray type organic plants growing system:

A. Construct a tray automatic turning and dumping system- circumferential rolling type growing tray material turning and dumping system: After a picked tray is turned at this position, the grown materials are damped in a

previously grown material stock bin so as to conveniently feed the previously grown materials in a screening system to screen the residual roots, stems and leaves. The system is designed into a circumferential rolling growing tray turning system, and each picked tray is turned by 360 degrees at this position, and returned back to a primary state after being turned; during the reversion process of an empty tray, when a tray rack forms a 15-degree angle with the plane, a locking device is slipped off so that the tray automatically slides in next conveying system along the tray rack and then enters an automatic loading system for loading.

B. Construct a screening system: Use a bucket type elevator or spiral elevator to elevate the grown material in the stock bin to a rotary screening machine, to remove the plants roots, stems and leaves remained after picking, and feed the grown material after screening into the stock bin of a batching system.

C. Construct a homogeneous stirrer system to stir the grown material uniformly: feed the prepared grown material from the stock bin to the homogeneous stirrer to stir uniformly and then feed the grown material to an automatic disinfection system.

D. Construct the automatic disinfection system: Adopt an electric power steamer and a special waveguide generator to perform thorough disinfection on the grown material comprehensively.

E. Construct a planted material automatic loading system: Load the disinfected material into the growing tray and feed the material to the automatic sowing system.

F. Construct an automatic sowing system: Adopt an air-aspiration type sower to perform automatic sowing operation in the tray loaded with the grown material.

G. Construct a carrier roller self-powered chain type tray automatic conveying system (comprising a running and pushing system): Automatically feed the sown tray in a parallel-moving tray growing area/automatically feed the tray with mature plants in a picking area/automatically feed the picked tray to a tray automatic turning system.

H. Construct a parallel-moving growing system: AN orbit bracket roller system is adopted for parallel-moving, on which the sown trays are running during the entire growth stage of the plants. The tray moves forward for a distance of one tray which is namely 1m in every 12 hours along the direction of forward motion of the tray. During each moving, one sown tray is fed in the growing area and one tray that can be picked is delivered out the growing area. When the tray is moving, a water curtain type watering system is started to water the plants. Before watering, an automatic temperature and humidity measuring system may automatically finish the measurement of the temperature and humidity in the grown material in the tray, and determine the watering amount according to the humidity (the humidity of the grown material is controlled at 50%-60% generally, which may be adjusted according to different plants demands). The watering amount is controlled through the running speed of the tray, and the running speed of the tray is realized by adjusting and pushing a screw variable frequency motor.

I. Construct an automatic water curtain type watering system to finish watering the plants in the tray.

J. Construct the temperature and humidity automatic measuring system: The measuring system may regularly perform temperature and humidity measurement on the grown material in the growing tray so as to determine the water required by the plants.

K. Construct a manipulator automatic plants picking system to harvest and sort mature plants.

L. Construct an automatic packaging system to automatically weigh and package the plants fed from the picking system.

Thus, the entire system is completely constructed.

3. Manufacture trays: The trays are manufactured by stainless steel materials so as to prevent the tray materials from polluting the grown material. Other materials that are allowed to use by growing organic plants, may not bring harmful pollution to the growth of the plants, and can also be applied to the system, may be adopted as well.

Claims

1. An automated system for growing organic plants, comprising:
 - (A) a tray rotation system comprising:
 - (i) a tray rack for receiving trays containing used grown material;
and
 - (ii) a stock bin for collecting the used grown material,
wherein the tray rotation system is configured for rotating each tray received by the tray rack to transfer the used grown material in the tray into the stock bin;
 - (B) a screening system comprising:
 - (i) a bucket type or spiral elevator to transfer the used grown material in the stock bin;
 - (ii) a rotary screening machine for receiving the used grown material from the bucket type or spiral elevator, the rotary screening machine configured for removing plant residues from the used grown material; and
 - (iii) a batching stock bin for receiving the used grown material after screening;
 - (C) a disinfection system for receiving the screened grown material from the batching stock bin and disinfecting the screened grown material;
 - (D) a loading system for receiving the disinfected grown material from the disinfection system and loading the disinfected grown material into empty trays;
 - (E) a sowing system for sowing plants on the grown material in the trays;
 - (F) a parallel-moving growing system comprising a plurality of parallel lines, each line configured for loading the trays with the sowed plants;
 - (G) a water curtain type watering system for watering the sowed plants in the trays while the trays are moving forward in a direction parallel to the lines;
 - (H) a picking system for harvesting and sorting matured plants from the trays;

- (I) a packaging system for packaging the matured plants into packages;
and
- (J) a conveyor system for transferring the trays between the systems (A), (D), and (H).

2. The system according to claim 1, wherein the empty trays are transferred, by the conveyor system, from the tray rotation system to the loading system after the used grown material are transferred into the stock bin.
3. The system according to claims 1 or 2, wherein the trays are returned to the tray rotation system after the matured plants have been harvested from the trays, the trays containing material which have been used for growing the matured plants, wherein the used grown material in the returned trays is transferrable into the stock bin.
4. The system according to any one of claims 1 to 3, further comprising a stirrer system for stirring the used grown material fed from the batching stock bin.
5. The system according to any one of claims 1 to 4, wherein the water curtain type watering system is configured for discharging a curtain of water, such that the trays are watered sequentially while moving through the curtain of water.
6. The system according to claim 5, further comprising an actuation system for moving the trays forward.
7. The system according to claim 6, wherein the actuation system comprises a screw variable frequency motor for controlling a speed of moving the trays, thereby controlling an amount of water received by each tray while moving through the curtain of water.
8. The system according to any one of claims 1 to 7, further comprising an environment control system for controlling temperature and humidity levels in the trays.

9. The system according to any one of claims 1 to 8, wherein the trays are made of a stainless steel material.
10. The system according to any one of claims 1 to 9, wherein the plants comprise at least one of organic vegetables, organic fruits, organic crude medicines, and organic tobaccos.
11. An automated method for growing organic plants, comprising:
- feeding, by a conveyor system, trays containing used grown material into a tray rotation system comprising a stock bin;
 - rotating each tray to transfer the used grown material in the tray into the stock bin;
 - elevating, by a bucket type or spiral elevator, the used grown material in the stock bin to transfer to a rotary screening machine;
 - screening, by the rotary screening machine, to remove plant residues from the used grown material;
 - transferring the used grown material to a batching stock bin after screening;
 - feeding the screened grown material from the batching stock bin to a disinfection system for disinfecting the screened grown material;
 - loading the disinfected grown material from the disinfection system into empty trays;
 - sowing plants on the grown material in the trays;
 - loading the trays with the sowed plants onto a plurality of lines configured for moving the trays forward in a direction parallel to the lines;
 - watering, by a water curtain type watering system, the sowed plants in the trays while the trays are moving forward;
 - harvesting and sorting matured plants from the trays;
 - packaging the matured plants into packages.

12. The method according to claim 11, wherein the empty trays are transferred, by the conveyor system, from the tray rotation system for loading the disinfected grown material after the used grown material are transferred into the stock bin.

13. The method according to claims 11 or 12, further comprising returning the trays to the tray rotation system after the matured plants have been harvested from the trays, the trays containing material which have been used for growing the matured plants, wherein the used grown material in the returned trays is transferrable into the stock bin.

14. The method according to any one of claims 11 to 13, further comprising adding an amount of new material into the batching stock bin in response to a determination that there is insufficient used grown material in the batching stock bin.

15. The method according to any one of claims 11 to 14, further comprising stirring the used grown material fed from the batching stock bin.

16. The method according to any one of claims 11 to 15, wherein watering the sowed plants comprises discharging a curtain of water, such that the trays are watered sequentially while moving through the curtain of water.

17. The method according to claim 16, further comprising controlling a speed of moving the trays, thereby controlling an amount of water received by each tray while moving through the curtain of water.

18. The method according to any one of claims 11 to 17, further comprising controlling temperature and humidity levels in the trays.

19. The method according to any one of claims 11 to 18, further comprising weighing the matured plants before packaging them.