

Planting procedure for the creation of woody climate-carbon plantations

The patent application relates to a planting procedure for the creation of woody climate-carbon plantations, in which procedure plantations are created using the seeds of woody plants integrated into a biodegradable material. The biodegradable material containing the seeds is placed directly on the production area with a film laying machine commonly used in agriculture. The produced wood can be used by the wood industry or for energetic purposes. Planting can also serve secondary re-cultivation purposes on damaged land, tailings and waste rock dumps, municipal waste landfills. Climate-carbon plantations serve climate protection purposes by the fact that their CO₂ emissions can be considered zero, they have no additional emissions, so the multi-purpose utilization of the plantation is carbon neutral.

Climate change, the current energy crisis, and the continuous increase in the demand for wood are all problems for which an effective solution needs to be found.

The creation of traditional climate-carbon and energy plantations has a high initial cost. Anything that requires a lot of financial resources necessarily leaves a large ecological footprint, increases the use of resources, and harmful emissions.

Furthermore, in general, plantations need significant amounts of irrigation water, so with the ever-increasing shortage of water their expediency is questionable.

In the case of plantations created by micropropagation, the creation of hybrid species excludes their use as bee pastures, because bees and other pollinating insects are very sensitive to any intervention that affects the genetic stocks of plants. In the long term, the pollen and nectar of hybrid and genetically modified species lead to the collapse of the colonies of pollinating insects and the death of their individuals, as we can already see today.

Currently, traditional energy plantations in Hungary can typically be divided into woody and herbaceous plants. Herbaceous plantations can be substituted by the stem residues from cereals, so it is not worth allocating resources to planting, as they are produced as a by-product. If we want to increase the yield of herbaceous stem residues, we need to increase the production area of cereals. The yield of herbaceous stem residues can be increased by increasing the production area of cereals.

The woody energy plantations are usually poplar and willow species, created by planting cuttings, and false acacia and empress tree (Paulownia) species, created by planting saplings.

The planting costs of these species include mainly the costs of soil preparation, and the costs of the production, cultivation of propagating material. The soil is prepared with heavy duty agricultural machinery performing the following types of work:

- disc harrowing
- deep loosening
- medium deep ploughing
- combined cultivation on three occasions in order to make the land flat.

The preparation of the soil is performed by machines powered by fossil fuels, weighing several tons, whose weight and activity have an adverse effect on the structure and fauna of the soil. Petroleum-based fuels greatly increase the harmful emissions, so this cannot be considered a climate-friendly technology. Combined cultivation on multiple occasions involves additional energy consumption. These work processes need to be reduced by changing to a soil-friendly technology. The fossil energy source needs to be replaced by a renewable, zero-CO₂ energy source.

The poplar, willow and empress tree species require a considerable amount of water, as they are adapted to wet, swampy habitats, where the soil has a high water and nutrient content. In order to achieve a rapid growth rate with these species, the energy plantation needs to be planted in high-quality agricultural land, which in turn reduces the agricultural land used for food production.

If poorer quality land is available, the replenishment of nutrients and water involves very high costs. A high cost necessarily leaves a large ecological footprint, so its climate protection balance and energetic balance are not sufficiently positive.

Highly productive lands need to be reserved for food production. The cultivation costs need to be reduced. Such species and technologies need to be used that bring good results even under unfavourable conditions, or on damaged land. There is a very short period of experience with the use of genetically modified and hybrid species, and the effects so far have proven to be very unfavourable: they exhaust the agricultural land, inhibit the reproduction of pollinating insects.

Planting false acacia saplings is practically a two-step process, with soil preparation on two occasions: first seeds are sown to produce saplings, then the saplings are removed and planted in their final place.

Soil preparation on two occasions, and the removal and replanting of saplings definitely involves additional costs. Furthermore, the cutting of the root system of the saplings sets back the development of the individual trees by one or two growing seasons, which is a significant loss.

Patent No. JPH06185065A discloses a tree planting method, in which seeds are attached and held directly on a reticulate body, and thus planted. The seeds are protected by the reticulate body, and when the seeds germinate, the reticulate body is decomposed.

The reticulate body is formed by employing combined yarn rayon, in which at least one of a high-molecular emulsion or a water-soluble polymer is added internally to a viscose solution.

Patent No. KR20100091540A discloses a seeding method, in which plant seeds are placed in a geotextile consisting of corn cotton or jute, or corn cotton mixed with coir fibre. The seeds are scattered between two layers, and the corn cotton is decomposed underground when the seeds germinate.

Patent No. JP2001123450A discloses a bag body, which is biologically degraded through hydrolysis to make a degraded final product converted completely into a substance existing in the natural world. The bag body comprises woven or knitted cloth using a biodegradable aliphatic polyester fibre, inside which a biodegradable sheet mounted with seeds and/or a fertilizer and manure is arranged.

A disadvantage of the above solutions is that the production of the biodegradable materials containing the seeds is complicated and expensive, furthermore, it is difficult to place them on large production areas.

The aim of the invention is to eliminate the above deficiencies, and to provide a procedure for the creation of energy plantations, the costs of which do not exceed the costs of creating regular plantations, with no or negligible need for irrigation water, and a stable genetic stock that does not pose a threat to pollinating insects.

An aim is to significantly reduce the resources required for soil preparation, as it is not necessary to prepare the land in seedbed quality. Deep loosening, and combined cultivation on multiple occasions can be omitted.

Another aim is to optimize the amount of propagating material used, and to ensure an easy and quick placement of the seeds on the production area, without preliminary soil preparation.

Yet another aim is to ensure that the seeds are placed at a specific spacing and depth, regardless of the unevenness of the soil, and that the density of the created plantation can be planned.

Still another aim is to prevent weeding, and thereby to eliminate the need for weed control until the seeds emerge.

A further aim is to fend off the energy crisis by providing an own energy source.

Still a further aim is to provide border protection functions, e.g. along the national borders, and private property protection functions.

The set aims are achieved in such a way that the seeds of woody plants are integrated into a biodegradable material before placing them on the production area, before integration the row and seed spacing is planned, by taking into account the characteristics of the production area and the seed species, and the seeds are arranged accordingly during the integration, so the density of the plantation will correspond to the planned density.

Thus, the invention relates to a planting procedure for the creation of woody climate-carbon plantations, by integrating the seeds of woody plants/the seeds of root-sprouting tree species, preferably the seeds of false acacia, or the seeds of thorny locust, into a biodegradable material, and by placing the biodegradable material directly on the production area with a film laying machine commonly used in agriculture.

The procedure according to the invention can be implemented with any commercially available biodegradable material: film, fleece, fabric, string, paper tape or floral foam.

The biodegradable material is, for example, film/fleece made from corn starch or potato starch; fabric made from hemp or flax; string made from hemp or flax.

The seeds are integrated into the biodegradable material before placement on the production area, preferably on the production line during the production of the biodegradable material, in such a way that a subtask allowing the integration of

properly prepared seeds is inserted in the production line process during the production of the material of the desired width, or the seeds are integrated into the produced biodegradable material by means of a seed-tape making machine.

The integration of the seeds into the biodegradable material is implemented by placing the seeds between two layers of film, or two layers of fleece, or two layers of fabric, or two paper tapes in such a way that the seeds are placed on the lower layer of the film, fleece or fabric, or on the lower paper tape layer at the determined seed and row spacing.

The layers laid on top of each other, containing the seeds, are fixed to each other with water-based glue, or by tacking or basting using thread made from the same material, thereby the seeds are also fixed without displacement, maintaining the determined seed and row spacing.

This way a tape of the determined width is produced, made from a biodegradable material, and containing the seeds at the determined seed and row spacing, which can be placed directly on the production area with a film laying machine used in agriculture. The tapes are preferably placed parallel to each other, and at a distance of 70-100 cm from each other.

The planting procedure for the creation of climate-carbon plantations according to the invention is also suitable for the creation of a border protection strip. In this case, preferably the seeds of thorny locust are used, and the tapes containing the seeds of thorny locust are placed directly next to each other on the production area, thereby creating a border protection strip.

The integration of the seeds into strings is implemented by twisting.

The seeds are integrated into floral foam one-by-one by insertion.

A film laying machine is also suitable for laying strings, as strings are also in rolls, just as films, the technological modifications can be made by setting the machine accordingly.

A film laying agricultural machine can lay multiple rolls at the same time.

The film tape, or fleece tape, or fabric tape, or paper tape, or string is covered by maximum 5 mm of soil or less.

The type of biodegradable material is chosen depending on the soil and climatic conditions of the plantation to be created.

In the biodegradable material, the seeds are placed at a row and seed spacing that is appropriate for the species, and for the characteristics of the production site. The width of fabric, film, fleece tapes, and paper tapes ranges from 10 cm to 100 cm.

The seeds are arranged in the tape made from a biodegradable material according to a planting plan.

For example:

1. in the case of a twin-row planting pattern:
 - row spacing: 12 cm
 - seed spacing: 25 cm
 - tape width: 25 cm
2. in the case of a three twin-row planting pattern:
 - row spacing: 12-24-12-24-12 cm
 - seed spacing: 5-10 cm
 - tape width: 100 cm

The seeds of any root-sprouting tree are suitable for creating plantations according to the invention. The preparation of the seeds to be integrated into the biodegradable material includes the following processes: cleaning, sieving, and then scarification (abrasion of the seed coat to facilitate germination) of the seeds.

If necessary, chemical dressing, as required by the conditions of the production area (to protect the sprouts from insects, bacterial and fungal pests).

Preferably, the seeds of false acacia (*Robinia pseudoacacia*), or thorny locust (*Gleditsia triacanthos*) are planted. The long and strong thorns of the thorny locust make it suitable for the creation of a border protection strip providing protection against all kinds of two-legged and four-legged intruders.

The dressed seeds of false acacia, collected primarily from domestic stock, are integrated into a biodegradable material. False acacia (*Robinia pseudoacacia*) is well-known for its fast growth, resilience, it is undemanding and grows even on the poorest soils.

It has been bred in Hungary for more than 250 years, it has adapted to the local conditions, its genetic stock is stable and free from genetic modification.

Characteristics of false acacia:

- Low water demand, drought tolerance

- Soil-binding ability
- It has papilionaceous flowers, adds nitrogen to the soil
- It produces "planting soil" in 2 years
- The biodiversity at leaf-litter level is extremely high
- Closed technology-water retention capacity
- High individual numbers
- Its deep-penetrating root system brings washed down nutrients back to the soil surface.
- Secondary energetic utilization - returning ash to the plantation as nutrient.

As a honey plant, the honey obtained from it is of the best quality. It has a high dry matter content, its moisture content is only 35% at the time of harvesting, compared to the 65% moisture content of oak, the 70% moisture content of beech, and the over 70% moisture content of poplar and willow. Furthermore, it contains materials that promote combustion even when it is wet, so it is excellent for energetic utilization.

The foliage of false acacia is extremely suitable for fodder purposes. Targeted studies have found that its crude protein content is higher than that of high-quality alfalfa flour, however, its fibre content is lower, making it easier to digest. Due to its rapid growth, and high individual numbers, it makes possible the production of wood mass, while protecting the soil and the forests.

The energetic utilization of the produced wood mass can take place in electrical thermal power plants. The electricity generated in this way has zero CO₂ emissions, because it only releases the carbon sequestered a few years before, so it does not add to the CO₂ cycle. The electricity generated in this way is carbon-neutral green electricity. If electric powered machines are used for planting and soil preparation, and their batteries are charged with green electricity generated by the power plant, fossil-based diesel fuel can be eliminated from the system. This way, a completely self-sufficient system, independent of external fossil energy sources is obtained.

The direct utilization of solar and wind energy shows extremely high hysteresis in long-term performance, their availability is contingent on the weather conditions. And energy generated from domestic fossil energy sources further increases the harmful emissions.

The biomass produced by climate-carbon plantations can provide continuous and long-term supply for biomass-based thermal power plants in the form of wood chips.

The planting procedure according to the invention is described in detail by way of the following examples, where

Figure 1: is a schematic drawing of a twin-row planting pattern of false acacia seeds;

Figure 2: is a schematic drawing of a three-row planting pattern of false acacia seeds;

Figure 3: is a schematic drawing of the creation of a border protection strip by planting thorny locust seeds.

Example 1:

The creation of a plantation starts with the examination of the production site.

The examination of the production site serves the purpose of determining the suitability of the selected production area. A sampling pit needs to be dug on the area, to a depth of about 2 m. The sampling pit can be used to find out the composition and structure of the soil, and whether there is stagnant water at a depth of 2 m. The number of required sampling sites varies depending on the area and the soil conditions. In general, for an area of 15-20 ha it is sufficient to dig one sampling pit to a depth of 1,5-2 m. The sample is tested in a laboratory, on the basis of which an expert opinion is issued. Planting can start in the possession of the expert opinion - stating that the area is suitable.

Planting is performed typically on several hectares. From the point of view of economy of scale, production needs to be performed on a large scale, using a plot size of 20 ha. But it also brings significant economic results on a smaller scale.

After the examination of the production site, the planting procedure continues with soil preparation. Soil preparation consists of disc harrowing and combined cultivation. By combined cultivation, the top soil broken up by disc harrowing is levelled to a sufficient degree. Combined cultivation is performed on the production area on maximum two occasions, if necessary.

Figure 1 is a schematic drawing of a twin-row planting pattern of false acacia seeds 2.

A biodegradable, corn starch-based film tape 1, into which prepared false acacia seeds 2 are integrated by means of a seed-tape making machine, is placed on the prepared soil. The false acacia seeds 2 are collected from a production stock of Robinia

Pseudoacacia, that is false acacia. The collected propagating material is cleaned by sieving, then the seed coat is scarified in a rotatable drum having an abrasive surface. After scarification, the seed is dressed with a pesticide approved for the species. Then the false acacia seeds 2 are placed into the hopper of a seed-tape making machine, from where the false acacia seeds 2 move onto the lower film layer at a seed and row spacing according to a planting plan, and the upper film layer is placed and fixed on them, keeping the false acacia seeds 2 stable and orderly in the film tape 1. In the example, the two film layers are fixed to each other with water-based glue.

The width of the film tape 1 according to the example is 25 cm, in which the false acacia seeds 2 are arranged in twin rows, at a row spacing of 12 cm. The seed spacing between false acacia seeds 2 in the same row is 25 cm. The twin rows are offset, the seeds are arranged diagonally, allowing for more growing room. In the example the rows are offset by 12.5 cm.

Planting on the production area is performed at the end of May.

The 25 cm wide film tape 1 is placed on the spindle of a film laying machine in a roll. Several film tapes 1 can be placed side by side on the spindle of the film laying machine. An 80 cm spacer between the film tapes 1 ensures the row spacing between the tapes, so the film laying machine can lay several film tapes 1 in parallel at the same time, ensuring a spacing of 80 cm between the film tapes 1 placed on the production area.

The side discs of the film laying machine cover the film tape 1 in a narrow strip with maximum 5 mm of soil.

Example 2:

The three-row planting procedure includes the same processes as the twin-row planting procedure.

In the case of planting according to Figure 2, the biodegradable, corn starch-based fleece tape 3 contains false acacia seeds 2 in three rows.

In the three-row planting procedure, the width of the fleece tape 3 is 37 cm, the row spacing is 12 cm, and the seed spacing is 25 cm. The spacing between two fleece tapes 3 is 80 cm. The individual rows are offset by 12,5 cm.

Example 3:

Figure 3 shows the creation of a border protection strip 5. Thorny locust (*Gleditsia*) is very favourable for the creation of a border protection strip 5, because due to its density, and large poisonous thorns containing formic acid, it forms an impenetrable barrier. For the creation of a border protection strip 5, three biodegradable, corn starch-based film tapes 1 are placed next to each other with a film laying machine. The width of one film tape 1 is 96 cm, so the width of the growing sprouts forming the border protection strip 5 is 288 cm. The film tape 1 contains thorny locust seeds 4, where the row spacing between the thorny locust seeds 4 is 12 cm, and the seed spacing is 25 cm.

The figure shows an access road 6 between two border protection strips 5. According to the example, an 800 cm wide access road 6 runs along the border protection strip 5, providing access for the vehicles of the border protection service, on the other side of which another border protection strip 5 is created.

An unexpected effect of the procedure according to the invention is that known technological parts are combined in a way not used, not known until now, in a much more cost-effective way, with a larger product volume, and a broader spectrum of use.

Claims

1. A planting procedure for the creation of woody climate-carbon plantations, by integrating the seeds of root-sprouting, seed-propagated tree species into biodegradable fabric, film or fleece, characterized in that the seeds are placed between two layers of the fabric, film or fleece in an orderly manner, then the two layers are fixed to each other, and the tapes formed in this way, containing the seeds in an orderly manner, are placed directly on the production area in parallel to each other, at a given spacing from each other, with a film laying machine commonly used in agriculture.
2. The planting procedure for the creation of woody climate-carbon plantations according to claim 1, characterized in that false acacia seeds (2) are integrated into biodegradable fabric, film or fleece.
3. The planting procedure for the creation of woody climate-carbon plantations according to claim 1, characterized in that thorny locust seeds (4) are integrated into biodegradable fabric, film or fleece.
4. The planting procedure for the creation of woody climate-carbon plantations according to any of claims 1 to 3, characterized in that the biodegradable fabric is made from hemp or flax.
5. The planting procedure for the creation of woody climate-carbon plantations according to any of claims 1 to 3, characterized in that the biodegradable film or fleece is made from corn starch or potato starch.
6. The planting procedure for the creation of woody climate-carbon plantations according to any of claims 1 to 5, characterized in that the layers laid on top of each other, containing the seeds, are fixed to each other with water-based glue, or by tacking or basting using thread made from the same material.
7. The planting procedure for the creation of woody climate-carbon plantations according to claim 1 or 2, characterized in that tapes containing false acacia seeds (2) arranged in twin rows are placed in parallel to each other in such a way that the

spacing between the tapes ranges from 70 to 100 cm, and where the false acacia seeds (2) are arranged in a 25 cm wide tape at a row spacing of 12 cm, at a seed spacing of 25 cm, and the rows are offset by 12.5 cm.

8. The planting procedure for the creation of woody climate-carbon plantations according to claim 1 or 2, characterized in that tapes containing false acacia seeds (2) arranged in three rows are placed in parallel to each other in such a way that the spacing between the tapes ranges from 70 to 100 cm, and where the false acacia seeds (2) are arranged in a 37 cm wide tape at a row spacing of 12 cm, at a seed spacing of 25 cm, and the rows are offset by 12.5 cm.

9. The planting procedure for the creation of woody climate-carbon plantations according to claim 1 or 3, characterized in that thorny locust seeds (4) are planted in such a way that thorny locust seeds (4) are arranged in a 96 cm wide tape at a row spacing of 12 cm, at a seed spacing of 25 cm, and the rows are offset by 12.5 cm, and three 96 cm wide tapes are placed directly next to each other.