REPUBLIC OF SOUTH AFRICA

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PATENTS ACT, 1978

CERTIFICATE

In accordance with section 44 (1) of the Patents Act, No. 57 of 1978, it is hereby certified that:

XINJIANG INSTITUTE OF ECOLOGY AND GEOGRAPHY, CHINESE ACADEMY OF SCIENCES

Has been granted a patent in respect of an invention described and claimed in complete specification deposited at the Patent Office under the number

2022/00081

A copy of the complete specification is annexed, together with the relevant Form P2.

In testimony thereof, the seal of the Patent Office has been affixed at Pretoria with effect from the **30th** day of **March 2022**

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REPUBLIC OF SOUTH AFRICA FORM P2
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REGISTER OF PATENTS

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54	AFFORESTATION METHOD FOR SERIOUSLY SALINIZED LAND IN MID-LATITUDE DESERT GRASSLAND

AFFORESTATION METHOD FOR SERIOUSLY SALINIZED LAND IN MID-LATITUDE DESERT GRASSLAND

TECHNICAL FIELD

[01] The present invention relates to an afforestation method for a desert salinized land. The method is applicable to afforestation greening of a seriously salinized land in mid-latitude desert grassland, and has great reference significances for afforestation of other seriously salinized lands.

BACKGROUND ART

[02] Saline soil is usually distributed in arid and semi-arid areas. Since the salty soil accumulates too much salt, it will cause poisonous damage to plants, seriously affect the growth and development of plants, and damage the soil structure, leading to damage to the ecosystem and desertification.

[03] The climatic conditions in the mid-latitude desert steppe area are harsh, with extreme cold in winter (as low as -52°C) and windy snow; in summer, it can reach 35°C, with drought and little rainfall. In addition, most of the desert grassland areas are low and flat, and calcium deposits are common. After the snow melts in the spring, local drainage will be caused, and water will be accumulated in the surface of soil. Moreover, with the evaporation, salt return in the summer, and the soil will become hardened. The salinization is serious, and the effect of conventional afforestation is extremely poor. This is different from the common saline soil areas in temperate arid and semi-arid areas. In addition to the limitation of soil salinity and moisture on plants, low temperature conditions also greatly limit the types of tree species for afforestation and greening. Therefore, the superposition of multiple unfavorable constraints has resulted in low survival rates and poor construction effects of urban greening and peripheral protection forest systems in the region.

[04] Based on years of afforestation experiment and practice in saline-alkali land in arid areas, the present invention provides an afforestation technology and method suitable for seriously seriously salinized land in mid-latitude desert grassland, overcomes the limitation of soil salinity, builds a protective forest belt, enriches tree species for greening, and improves afforestation and greening effect .

SUMMARY

[05] The object of the present invention is to provide an afforestation greening of a seriously salinized land in mid-latitude desert grassland, to improve the afforestation quality in a region, and provide technical support for ecological environment construction projects. The object of the present invention is achieved in a way that: an afforestation method of a seriously salinized land in a mid-latitude desert grassland, comprising five steps: I, tree variety selection; II, land preparation; III, forest belt layout; IV, soil improvement and afforestation; and V, maintenance management, with the procedures of: variety selection→land preparation→soil

improvement→afforestation→management and maintenance.

[06] According to the technical mode, tree variety selection comprises the following two main technical contents:

[07] a. Arbor varieties: salt-tolerant and cold-resistant fraxinus chinensis, elaeagnus angustifolia, ulmus pumila , etc. are selected.

[08] b. Shrub varieties: waterlogging, salt and cold resistant tamarix hispida, tamarix leptostachys, nitraria sibirica and the like are selected.

[09] c. Herbs: high salt-rich halophytes such as suaeda salsa and salicornia europaea are selected.

[10] According to the technical mode, land preparation comprises the following two main technical contents:

[11] a planting region is transformed into shapes of trapezoids by using large-size machinery, as shown in FIG. 1. A trapezoid is 2 m wide on the top, 3 m wide at the bottom, and 0.6 m high, and the distance between the trapezoids is 1 m.

[12] According to the technical mode, forest belt layout comprises the following two main technical contents:

[13] a. A belt-shaped row mixing mode is adopted, and the tree varieties are mixed interlaced. 6 rows form one belt, the spacing between belts is set as 4 m as a machinery road, and may also be used for weeding and mechanical irrigation later.

[14] b. Afforestation planning is made in a land preparation trapezoid mode, salt-tolerant and stress-resistant arbor and shrub varieties are planted at upper parts of the trapezoids, including arbors such as fraxinus chinensis, elaeagnus angustifolia and ulmus pumila, and shrubs such as tamarix hispida, tamarix leptostachys, tamarix elongata and nitraria sibirica.

[15] c. Salt-rich plants suaeda salsa and salicornia europaea are planted between the trapezoids, and the salt-rich plants can both enrich salts, and reduce ground water through plant transpiration. The suaeda salsa and salicornia europaea can be harvested once every year by using machinery, and can be used as silage after harvested.

[16] According to the technical mode, soil improvement and afforestation comprises the following two main technical contents:

[17] a. Soil improvement: in planned trapezoid planning points, round planting pits with a pit radius of 40*40 cm (width*depth) are dug by a plant spacing of 1 m *1 m, and dug soil is uniformly mixed with 5 kg of phosphogypsum.

[18] b. Afforestation: afforestation is carried out according to a conventional afforestation technology, and improved soil is uniformly compacted, and thoroughly watered once after afforestation.

[19] According to the technical mode, maintenance management comprises the following two main technical contents:

[20] In order to improve the survival rate of forest trees, in a first year of planting, watering is carried out once immediately in mid-to-late May after planting is completed, and watering once again in middle June or early July, with a water volume of 30 kg each time. In growth seasons, watering is favorably carried out twice, and weeding is carried out twice. After the first year of planting, main tasks are to monitor diseases and insects, prevent rabbits and rodents, prevent livestock from trampling, and investigate the

growth of trees, without manual irrigation.

[21] The afforestation method for the seriously salinized land in mid-latitude desert grassland has the characteristics as follows: firstly, through microtopography transformation, a salt distribution range is changed, then plant root systems are distributed in a soil body of a light degree of salinity, and this is the key principle of application of the method. Secondly, due to adoption of the phosphogypsum, the soil alkalization degree can be alleviated, soil calcium ions can be replenished, the adsorption proportion of sodium ions in the soil can be controlled, and salt damage of plants can be alleviated. Thirdly, an afforestation mode suitable for stereoscopic combination of trees, shrubs and grasses is established, so that not only the impact of strong winds is effectively resisted, but also the salts in the soil can be reduced. In addition, through plant evapotranspiration, the ground water can be lowered, the degree of salinization is reduced, which is an innovative application of the method, and highlights technical progress.

[22] BRIEF DESCRIPTION OF THE DRAWINGS

[23] Figure 1 is a Planting schematic diagram of trapezoid forest belts.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[24] Example: peripheral protection forest project of Nur Sultan, the capital of Kazakhstan

[25] The newly-built capital of Kazakhstan, Nur Sultan, is located at 51.1º north latitude. The winter is long for more than 5 and a half months, cold and windy, and the lowest temperature can be -54℃. It is dry in summer, with an average annual rainfall of 295 mm. The soil is all calcium soil with heavy stickiness and poor water permeability, with a salt content as high as 2.8 g/kg. The soil is hardened and seriously salinized. Due to a flat terrain, a waterlogging land is easily caused after winter snow melts, resulting in delay of an afforestation period. A conventional afforestation method causes large-scale death of seedlings, and the survival rate of plants is extremely low.

[26] In late May of 2018, the technology method of the present invention was implemented on a heavy saline-alkali soil test area in the west of Nur Sultan, and afforestation was successful. A total of plants of fraxinus chinensis, ulmus pumila and acer negundo were planted, in an area of 20 mu. The survey in October in autumn showed that the survival rate reached 85%, and the plants were growing vigorously. In 2019, another 100 mu was popularized and planted, which greatly improved the quality and effect of afforestation in the area, made a great contribution to improvement of the ecological environment quality of the capital, and was highly praised by local residents and government departments.

[27] Specific operation steps:

[28] 1.Soil preparation was carried out with machinery, namely microtopography transformation that trapezoids were 2 m wide on the top, 3 m at the bottom and 0.6 m high as required, the distance between lower bottoms of two trapezoids was 1 m, and the distance between tops was 2 m, was carried out.

[29] 2. Selected fraxinus chinensis, ulmus pumila and elaeagnus angustifolia were planted in rows, two rows were planted at the upper part of each trapezoid, and the

plants were distributed in an upside-down triangle.

[30] 3.Dug soil and phosphogypsum were uniformly mixed in a ratio, and after the plants were planted in pits, the mixed soil was thrown into planting pits and was compacted.

[31] 4. After planting at the upper part of the trapezoid was completed, a cofferdam was formed at the root part of each plant, irrigation was carried out immediately with a water trolley, and each plant was irrigated with about 30 kg of water.

[32] 5. The seeds of suaeda salsa were sown with an amount of 200 g/mu on the surface of the soil with a width of 1 m in the middle of the trapezoid, and then raked twice with a nail rake.

[33] 6. At the beginning of July, irrigation was carried out once more with the water trolley on the road of 4 m between the belts.

WHAT IS CLAIMED IS:

1. An afforestation method for a seriously salinized land in a mid-latitude desert grassland, comprising the following steps:

a. microtopography transformation, namely transforming a planting region into trapezoid shapes by using large-size machinery, wherein a trapezoid is 2 m wide on the top, 3 m at the bottom, and 0.6 m high; the distance between lower bottoms of two trapezoids is 1 m; and the distance between tops is 2 m;

b. tree variety selection, namely selecting salt-tolerant and stress-resistant tree and shrub varieties for upper parts of the trapezoids, including trees such as fraxinus chinensis, elaeagnus angustifolia and ulmus pumila, and shrubs such as tamarix hispida, tamarix leptostachys and tamarix elongata; and selecting high salt-rich halophytes suaeda salsa or salicornia europaea between two trapezoids;

c. soil improvement, namely planting plants at upper parts of the trapezoids, and digging soil holes with a pit radius of 40*40 cm (width*depth) by a plant spacing of 1 m *1 m; and uniformly mixing dug soil with phosphogypsum in a ratio of 6: 1, and uniformly spreading the mixture into tree pits and compacting when plants are planted;

d. forest belt layout, namely carrying out forest row mixing, planting 6 rows for one belt, and setting a machinery road of 4 m between every two belts, for weeding and irrigation in early growth stages of plants; and

e. maintenance management, namely irrigating timely after planting in the first year, to play a role of pressing salts; weeding and preventing and controlling insects and diseases in middle stages of growth seasons; and at the end of growth seasons, harvesting suaeda salsa or salicornia europaea as forage grass or silage, from the second year, manual irrigation is not needed in late stage maintenance, and weeding is carried out timely by using machinery.

2. The method according to claim 1, wherein the pH value of the seriously salinized land of desert grassland in the step (a) is within 8.5-9.5, and the content of salts on a surface layer is up to more than 2.5%; a calcium deposit layer of 10-20 cm is distributed at 30 cm of a soil profile; the content of salts within 1 meter of the soil profile is greater than 1.5%; anions are mainly SO_4^{2-} and cl^-, and cations are mainly Na^+ and Ca^{2-}.

3. The method according to claim 1, wherein arbors and shrubs in the step (b) are seedlings of 2 years.

4. The method according to claim 1, wherein the phosphogypsum in the step (c) is capable of alleviating the soil alkalization degree, replenishing calcium ions to soil, and controlling the adsorption proportion of sodium ions in the soil.

5. The method according to claim 1, wherein an included angle of 60 degrees is formed between a forest belt direction and a main wind direction in the step (d).

The method according to claim 1, wherein the irrigation capacity in the step (e) is 30 kg/time.

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DRAWINGS

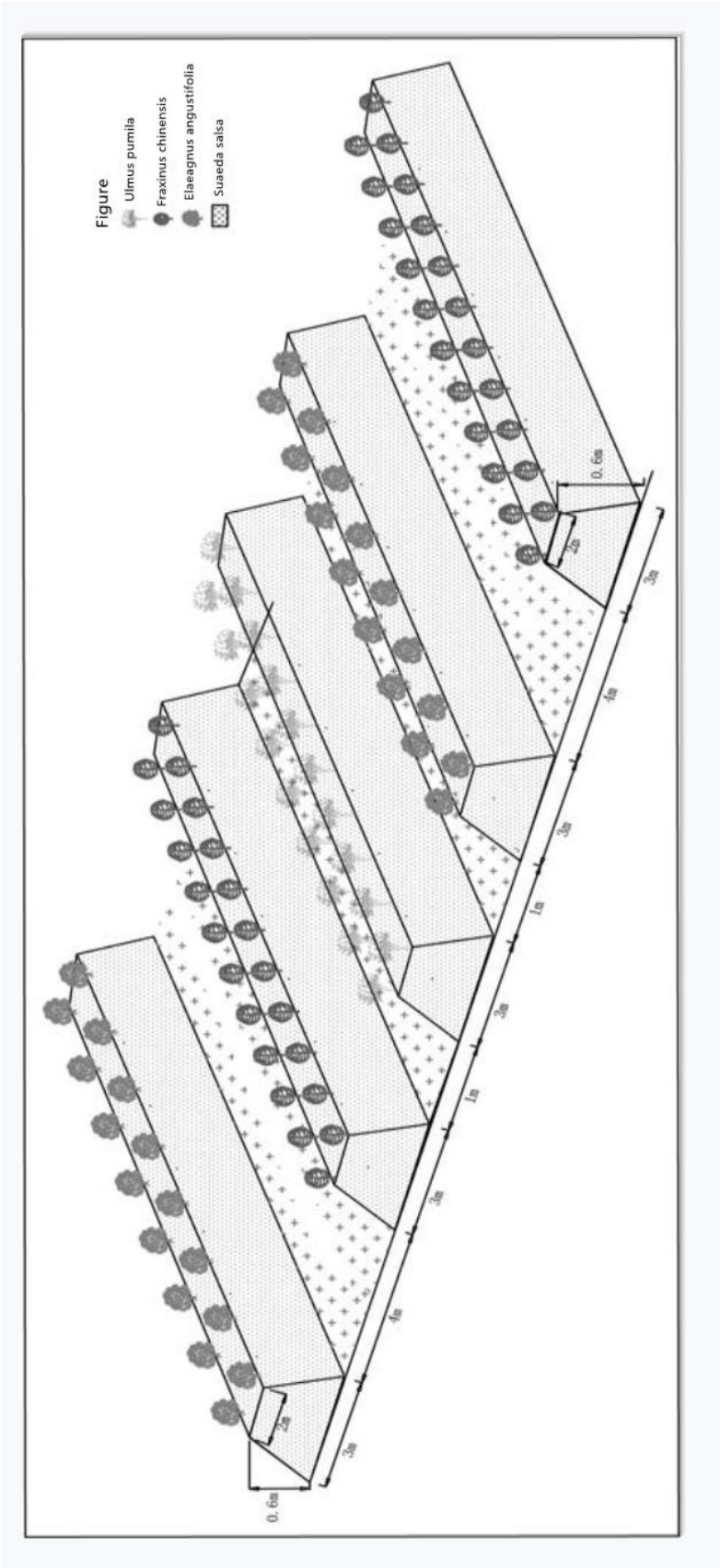

FIG.1

ABSTRACT OF THE DISCLOSURE

The present invention provides an afforestation method for seriously salinized lands in desert grassland.