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

2022/00068

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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Registrar of Patents

REPUBLIC OF SOUTH AFRICA FORM P2
PATENTS ACT, 1978
REGISTER OF PATENTS

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54	Title of invention
DRIP IRRIGATION METHOD OF SALINE WATER FOR PREVENTION OF SALT ACCUMULATION IN PROTECTION FOREST	

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COMPLETE SPECIFICATION

[Section 30(1) – Regulation 28]

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TITLE OF INVENTION

54	DRIP IRRIGATION METHOD OF SALINE WATER FOR PREVENTION OF SALT ACCUMULATION IN PROTECTION FOREST

DRIP IRRIGATION METHOD OF SALINE WATER FOR PREVENTION OF SALT ACCUMULATION IN PROTECTION FOREST

TECHNICAL FIELD

[01] The present disclosure relates to the technical field of protection forest irrigation, and in particular, to a drip irrigation method of saline water for prevention of salt accumulation in protection forest.

BACKGROUND ART

[02] Low precipitation and insufficient fresh water resources are important factors restricting the development of agriculture and forestry and ecological stability in arid areas. The use of groundwater, especially the exploitation and utilization of saline groundwater, has become a effective measure to solve the problem of shortage of water for ecological utilization. However, saline water irrigation not only provides ecological water utilization but also brings more salt into soil. In an arid area, the limited precipitation throughout the year is not enough to leach out the salt in the root zone of a protection forest. Therefore, long-term use of saline water for irrigation causes the salt to accumulate in soil, which not only restricts plant growth, but also facing the risk of soil salinization, and even threatens the soil quality and the sustainability of an ecological shelter forest.

[03] So far, Chinese patents (CN 104488661 B and CN 105993843 B) provide slight saline water irrigation methods for Lycium chinense Miller and Ziziphus jujuba Mill. cv. Dongzao in salinized irrigation areas, respectively, which can make full use of saline water resources to cover the shortage of fresh water resources while reducing the salt content in soil and also can alleviate soil salinization and ameliorate land. However, the irrigation water used in the two patents is only slight saline water (salinity<3 g/L). The prior art provides no method in which saline water with a high salinity is used to avoid or alleviate soil salinization and ensure that a protection forest continuously produces benefits.

SUMMARY

[04] An objective of the present disclosure is to provide a drip irrigation method of saline water for prevention of salt accumulation in a protection forest. The drip irrigation method of the present disclosure uses saline water with a high salinity for irrigation and effectively prevent soil accumulation in the protection forest.

[05] The present disclosure provides a drip irrigation method of saline water for prevention

of salt accumulation in a protection forest, including the following step:

[06] performing drip irrigation on desert soil during a growing period and the end of the growing period, where the drip irrigation uses saline water with a salinity of 4 to 30 g/L;

[07] the drip irrigation is performed during the growing period for 10 to 12 times, each for 6 hours; and the drip irrigation is performed once for 12 hours at the end of the growing period.

[08] Preferably, the growing period is from late March to late September each year.

[09] Preferably, the end of the growing period is in October.

[10] Preferably, the drip irrigation is performed by using a compensating drip irrigation belt.

[11] Preferably, a flow rate through each emitter is least 3 L/h.

[12] Preferably, the flow rate through each emitter is 3 to 3.5 L/h.

[13] Preferably, an amount of drip irrigation by each emitter each time during the growing period is 18 to 21 L.

[14] Preferably, an amount of drip irrigation by each emitter each time at the end of the growing period is 36 to 42 L.

[15] Preferably, during the drip irrigation, each emitter corresponds to one plant.

[16] Preferably, the drip irrigation is performed in divided drip irrigation zones.

[17] The present disclosure provides a drip irrigation method of saline water for prevention of salt accumulation in a protection forest. The drip irrigation method of the present disclosure involves one type of soil (desert soil), one irrigation manner (drip irrigation), two irrigation regimes (irrigation during the growing period and irrigation at the end of the growing period), and a variety of irrigation water (4 to 30 g/L saline water). Under the saline water drip irrigation conditions of the present disclosure, salt accumulation in soil in the main root distribution layer of the protection forest can be avoided or slowed, thereby ensuring that plants are not affected by salt stress and grow normally and promoting long-term stable functioning of the protection forest. The drip irrigation method of the present disclosure can also provide a reference for the use of saline water in extreme arid areas to prevent the risk of secondary salinization of soil.

BRIEF DESCRIPTION OF THE DRAWINGS

[18] FIG. 1 is a diagram showing plant root distribution (1-1) and soil salt distribution (1-2) provided in Example 1 of the present disclosure.

[19] FIG. 2 is a diagram showing horizontal and vertical distributions of salt in soil profile provided in Example 2 of the present disclosure.

[20] FIG. 3 is a diagram showing salt accumulation in soil under drip irrigation with water

different in salinity provided in Example 3 of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[21] The present disclosure provides a drip irrigation method of saline water for prevention of salt accumulation in a protection forest, including the following step:

[22] perform drip irrigation on desert soil during a growing period and the end of the growing period, where the drip irrigation uses saline water with a salinity of 4 to 30 g/L. Due to the characteristics of coarse texture, good permeability and fast penetration of desert soil, salt entering the soil can "come with water and go with water" in time, and therefore, the purpose of rapid leaching of salt can be achieved. The present disclosure has no particular limitation on the source of the saline water with a salinity of 4 to 30 g/L, and groundwater is preferred. In the present disclosure, saline groundwater is used in situ. A protection forest irrigation regime is drawn up scientifically according to the water-salt balance principle to effectively prevent or lower the concentration and quantity of salt accumulated in soil, so that the protection forest is not susceptible to the restriction of the soil salt content. The salt accumulation in the main root layer of the protection forest can be easily removed or alleviated without external force, thereby allowing for normal plant growth and promoting the protection effect and sustainability of the protection forest.

[23] Preferably, the drip irrigation is performed during the growing period for 10 to 12 times, each for 6 hours; and the drip irrigation is performed once for 12 hours at the end of the growing period.

[24] In the present disclosure, the growing period of plants is preferably determined before the drip irrigation. In the present disclosure, the growing period is from late March to late September each year. In the present disclosure, the end of the growing period is in October.

[25] In the present disclosure, the drip irrigation is performed by using a compensating drip irrigation belt. The present disclosure has no particular limitation on the source of the compensating drip irrigation belt, and any commercially available compensating drip irrigation belt well known to those skilled in the art may be used. In the present disclosure, before the drip irrigation, it is preferred to carefully inspect the head part of the drip irrigation and branch pipes and capillary pipes within the protection forest, and adjust the drip irrigation belt to ensure that the power, machinery, channels, etc. are running normally to wait for the scheduled irrigation. In the present disclosure, a flow rate through each emitter is preferably at least 3 L/h. In the present invention, the flow rate through each emitter is more preferably 3 to 3.5 L/h. In the present disclosure, an amount of drip irrigation by each emitter each time during the

growing period is 18 to 21 L. In the present disclosure, an amount of drip irrigation by each emitter each time at the end of the growing period is 36 to 42 L. In the present disclosure, during the drip irrigation, each emitter corresponds to one plant.

[26] In the present disclosure, the drip irrigation is performed in divided drip irrigation zones. It is preferred that one irrigation zone is 1 hectare. The irrigation time in different drip irrigation zones can be adjusted according to specific circumstances. For example, 2 to 3 drip irrigation zones can be combined into a group and the drip irrigation is performed simultaneously in the group. After the completion of the drip irrigation in this group, the drip irrigation is started in next group.

[27] The drip irrigation method of saline water for prevention of salt accumulation in a protection forest provided in the present disclosure will be further described in detail below in conjunction with specific examples. The technical solutions of the present disclosure include, but are not limited to, the following examples.

[28] **Example 1**

[29] Taking the water well in section K164+800 of Tarim Desert Highway protection forest as an example, the salinity of the groundwater was 18.36 g/L, and the protection forest to be irrigated was 4 kilometers long and 72 to 78 meters wide, with a total area of up to 31 hectares. According to the water output of the water well, this section of the protection forest was divided into 30 irrigation zones, each of which was about 1 hectare.

[30] Inspection of drip irrigation equipment for the protection forest: the head part of the drip irrigation and branch pipes and capillary pipes within the protection forest were carefully inspected, and the drip irrigation belt was adjusted to ensure that the power, machinery, channels, and the like were running normally to wait for the scheduled irrigation.

[31] Irrigation during the growing season: irrigation started around March 15 and lasted for 6 hours. Drip irrigation was performed in two irrigation zones each day. The irrigation period was about 15 days.

[32] Irrigation during the growing season: the irrigation ended in the middle of September. The irrigation was performed for about 10 times during the growing season.

[33] Irrigation at the end of the growing season: irrigation started around the beginning of October and lasted for 12 hours. Drip irrigation was performed in two irrigation zones each day. The drip irrigation of the whole irrigation area took about 15 days.

[34] The drip irrigation equipment was maintained at the end of the growing season. Drip irrigation valves were opened step by step to make the water in the drip irrigation pipes run out naturally, thereby preventing the drip irrigation pipes from cracking due to water storage

therein in the winter.

[35] The method of the present disclosure was applied to the ecological project of the Tarim Desert Highway protection forest. Due to the use of drip irrigation, the main plant root distribution layer of the protection forest was mainly distributed in the 20 to 150 cm soil layer, accounting for above 80% of the total root weight. Due to strong evaporation in the arid area, the surface soil in the range of 0 to 15 cm had a high salt content, and the main plant root distribution layer (20 to 150 cm) had a low salt content, which had not yet endangered the normal growth of plants. The overall growth of the protection forest was good, and the protection benefits and landscape effects had gradually emerged (see FIG. 1 showing the plant root distribution (1-1) and the soil salt distribution (1-2).

[36] Example 2

[37] Taking the protection forest at 6 km of Taqie Highway as an example, the salinity of the groundwater was 4.05 g/L, and the protection forest was 2.3 kilometers long and 72 to 78 meters wide, with a total area of 16 hectares. The protection forest was divided into 15 irrigation zones according to the distance from the irrigation well. Irrigation during the growing season: irrigation started on March 20. The irrigation of each section of the forest lasted for 6 hours. Drip irrigation was performed in three irrigation zones each day. Depending on the season, the irrigation period was 10 to 15 days.

[38] Irrigation during the growing season: irrigation ended at the end of September and lasted for 12 hours. Irrigation at the end of the growing season: irrigation started in the middle of October and lasted for 12 hours. Drip irrigation was performed in three irrigation zones each day. The drip irrigation of the whole irrigation area took about 5 days. The measured salt content in the soil is shown in FIG. 2 (the diagram showing the horizontal and vertical distributions of salt in soil profile, where 10 cm, 30 cm and 50 cm represent the horizontal distances between the sampling points and the emitter, and the vertical axis represents the vertical depth of the soil). Regardless of the horizontal or vertical distribution of salt, except for the salt accumulation due to salt encrustation formed by salt in surface soil, the salt content in the soil was less than 0.4%, and no salt was accumulated within the plant root range in the soil.

[39] Example 3

[40] The present technology was implemented in the entire ecological project system of 436 kilometers of Tarim Desert Highway protection forest. The salinity of groundwater along the Tarim Desert Highway was between 4 and 30 g/L. After irrigation for 8 years, five wells different in salinity along the Tarim Desert Highway were selected to be investigate with respect to soil profile salt content within the range of the forest. The results of the soil profile

salt distribution are shown in FIG. 3. The results showed that under the long-term high-salinity water drip irrigation condition, salt was not accumulated in the soil (below 20 cm), which would not cause salt damage to the protection forest plants that had grown for many years and would also not affect the normal growth of plants. Thus, the functioning of the Tarim Desert Highway protection forest and the sustainability of the ecological project could be guaranteed.

[41] The foregoing are merely descriptions of preferred embodiments of the present disclosure. It should be noted that several improvements and modifications can be made by a person of ordinary skill in the art without departing from the principle of the present disclosure, and these improvements and modifications shall also be deemed as falling within the protection scope of the present disclosure.

WHAT IS CLAIMED IS:

1. A drip irrigation method of saline water for prevention of salt accumulation in a protection forest, comprising the following step:

performing drip irrigation on desert soil during a growing period and the end of the growing period, wherein the drip irrigation uses saline water with a salinity of 4 to 30 g/L;

the drip irrigation is performed during the growing period for 10 to 12 times, each for 6 hours; and the drip irrigation is performed once for 12 hours at the end of the growing period.

2. The drip irrigation method according to claim 1, wherein the growing period is from late March to late September each year.

3. The drip irrigation method according to claim 1, wherein the end of the growing period is in October.

4. The drip irrigation method according to claim 1, wherein the drip irrigation is performed by using a compensating drip irrigation belt.

5. The drip irrigation method according to claim 1, wherein during the drip irrigation, a flow rate through each emitter is at least 3 L/h.

6. The drip irrigation method according to claim 5, wherein during the drip irrigation, the flow rate through each emitter is 3 to 3.5 L/h.

7. The drip irrigation method according to claim 6, wherein an amount of drip irrigation by each emitter each time during the growing period is 18 to 21 L.

8. The drip irrigation method according to claim 6, wherein an amount of drip irrigation by each emitter each time at the end of the growing period is 36 to 42 L.

9. The drip irrigation method according to claim 1, wherein during the drip irrigation, each emitter corresponds to one plant.

10. The drip irrigation method according to claim 1, wherein the drip irrigation is

performed in divided drip irrigation zones.

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Sibanda & Zantwijk Patent Attorneys

DRAWINGS

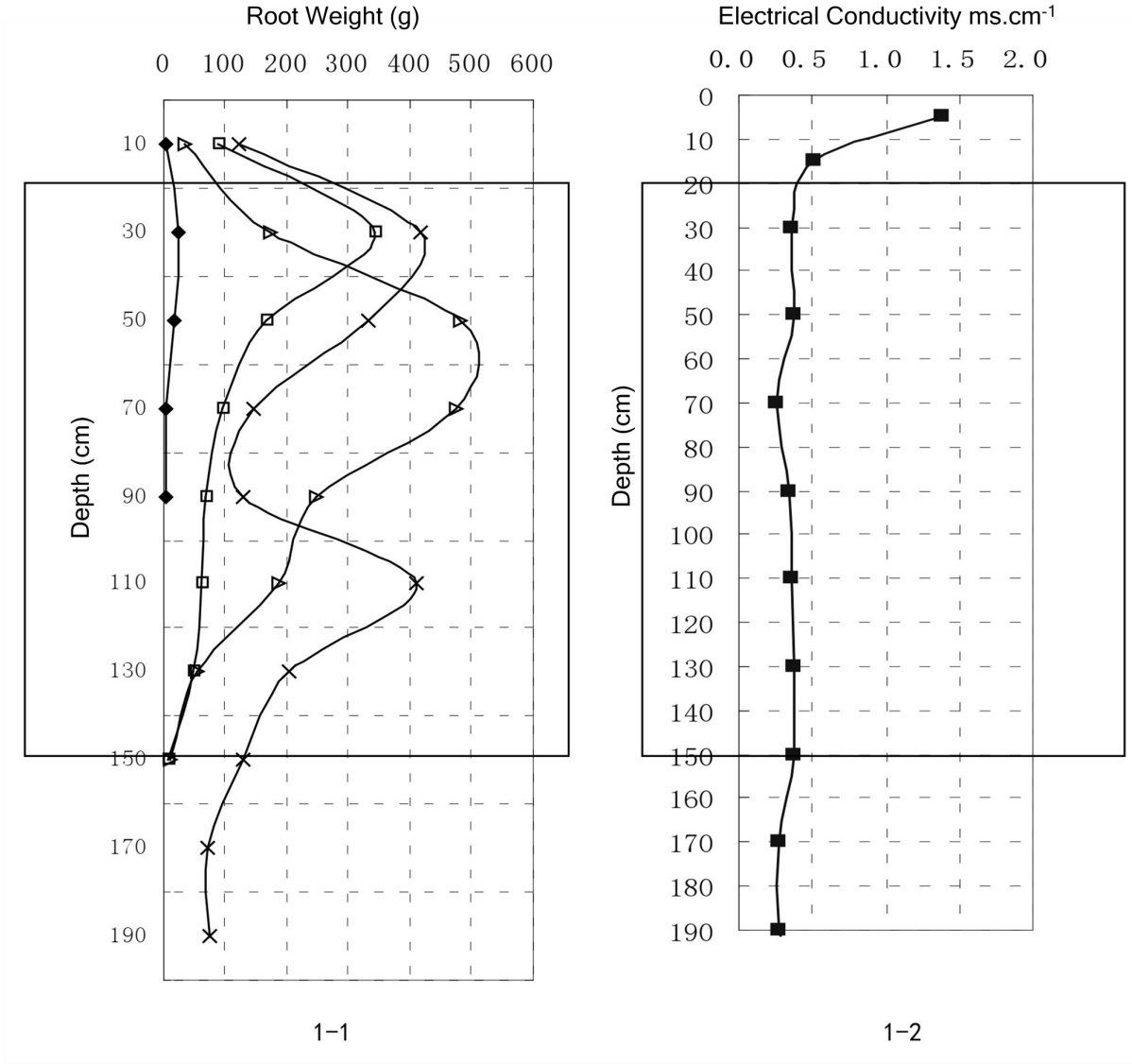

FIG. 1

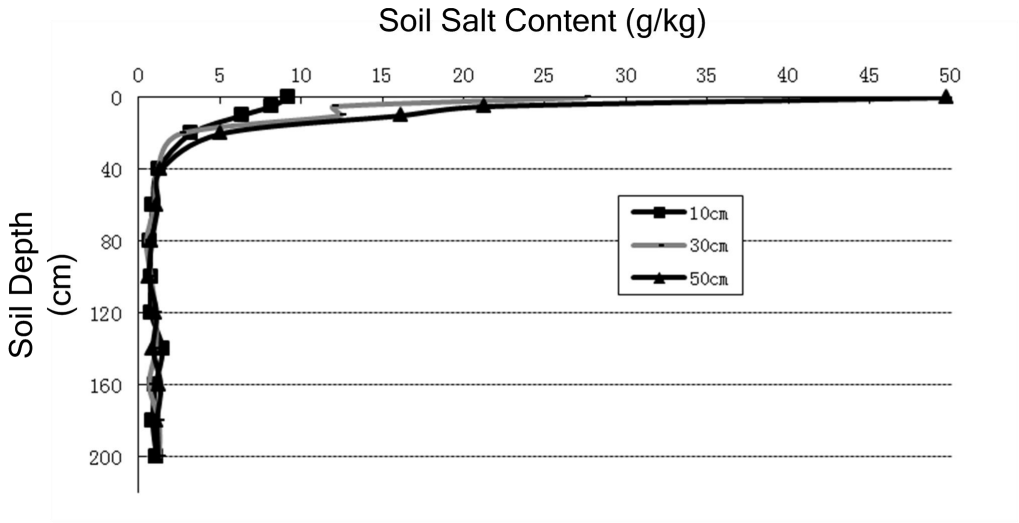
Soil Salt Content (g/kg)
0 5 10 15 20 25 30 35 40 45 50
0
40
80
120
160
200
Soil Depth (cm)
10cm
30cm
50cm

FIG. 2

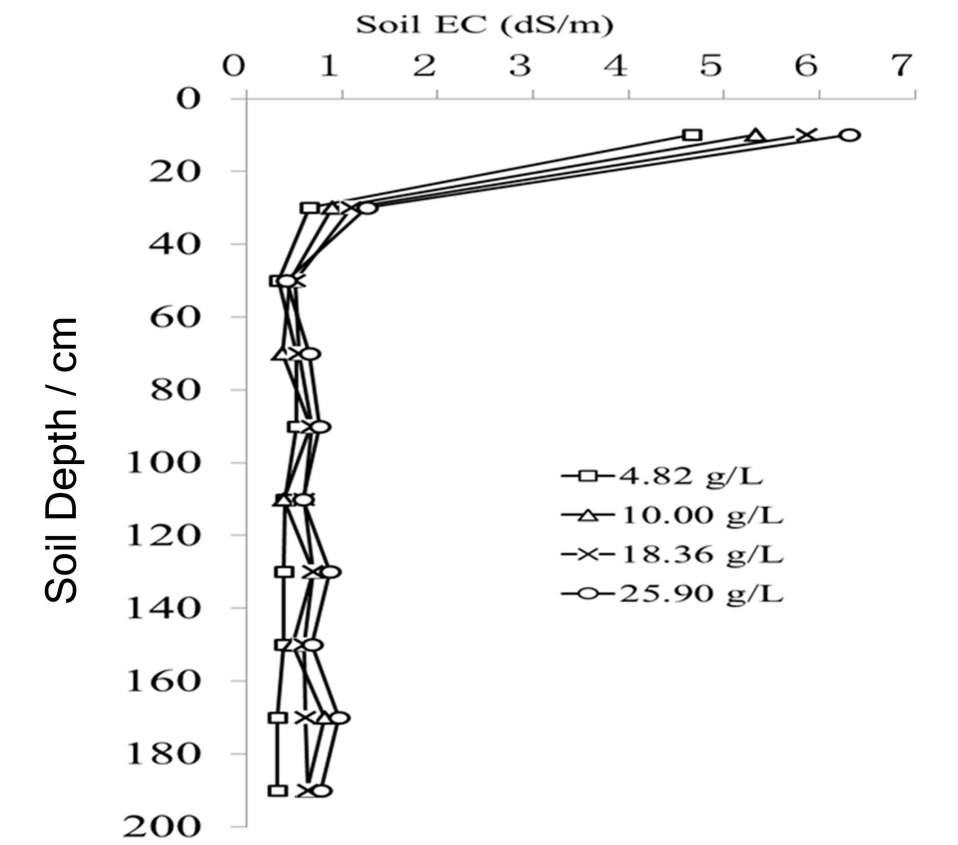
Soil EC (dS/m)
0 1 2 3 4 5 6 7
0
20
40
60
80
100
120
140
160
180
200
Soil Depth / cm
4.82 g/L
10.00 g/L
18.36 g/L
25.90 g/L

FIG. 3

ABSTRACT OF THE DISCLOSURE

The present disclosure relates to a drip irrigation method of saline water for prevention of salt accumulation in a protection forest and belongs to the technical field of protection forest irrigation. The drip irrigation method of the present disclosure includes the following step: performing drip irrigation on desert soil during a growing period and the end of the growing period, where the drip irrigation uses saline water with a salinity of 4 to 30 g/L; the drip irrigation is performed during the growing period for 10 to 12 times, each for 6 hours; and the drip irrigation is performed once for 12 hours at the end of the growing period. The drip irrigation method of the present disclosure can use saline water with a high salinity for irrigation and effectively prevent soil accumulation in soil in the protection forest.

ABSTRACT DRAWING

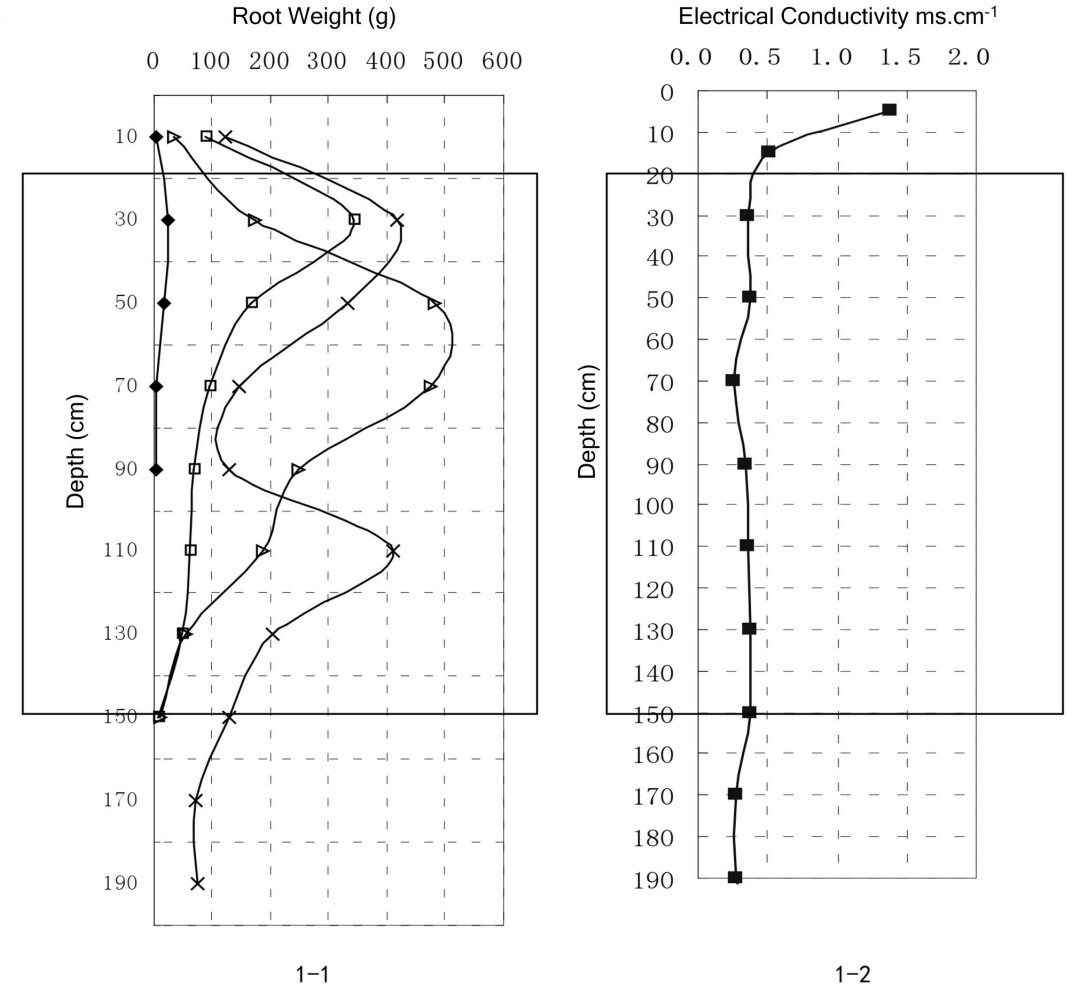

FIG. 1