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:

INSTITUTE OF SUBTROPICAL AGRICULTURE, CHINESE ACADEMY OF SCIENCES; HUNAN RICE RESEARCH INSTITUTE

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

2022/05819

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

In testimony whereof, the seal of the Patent Office has been affixed at Pretoria with effect from the 31st day of **August 2022**

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

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A rice planting method that saves water and fertilizer						
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COMPLETE SPECIFICATION

[Section 30(1) – Regulation 28]

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TITLE OF INVENTION

54	A rice planting method that saves water and fertilizer

A rice planting method that saves water and fertilizer

TECHNICAL FIELD

The invention belongs to the technical field of agriculture, and in particular relates to a rice planting method that saves water and fertilizer.

BACKGROUND

Rice is the staple food of nearly half of the world's population, and ensuring rice production is of great significance to global food security. Fertilizer is the main factor regulating the growth of rice. However, water resources are increasingly scarce, and environmental pollution caused by a large amount of chemical fertilizers has also attracted widespread attention. Rice water requirement includes physiological water requirement and ecological water requirement. Physiological water requirement refers to the water required for normal life activities during the growth of rice, including plant transpiration water consumption and water in plants. Ecological water demand refers to the amount of water needed to ensure the normal growth of rice and create a good ecological environment, including rice field evaporation and leakage. However, the physiological water demand of rice is far less than the ecological water demand, so there is a lot of room for water saving in rice planting. At present, paddy field irrigation mainly relies on flood irrigation, and the water is drained during the mid-season drying and drying in the mature period, resulting in serious loss of water and fertilizer and environmental pollution. Currently, the basic fertilizer application method in paddy field is to spread fertilizer on the field surface and then mix it with the soil. This conventional fertilization method makes the fertilizer easy to lose and volatilize. Therefore, there is an urgent need for rice planting methods that save water and fertilizer.

SUMMARY

The purpose of the invention is to provide a rice planting method that saves water and fertilizer, which is easy to implement, simple and convenient to operate, and reduces the amount of fertilization. Through the wide and narrow rows of seedlings distribution mode, it is convenient for mechanical deep

application of basic fertilizer, which reduces the loss of fertilizer and prolongs the fertilizer efficiency.

In order to achieve the above purpose, this invention provides the following technical solutions:

A, before plowing, evenly spread organic fertilizer in the field, and plow the soil with a plowing machine; after the plowing is finished, the soil is preliminarily broken by rotary tillage machinery for the first time, so that more than 90% of the clods are smaller than 5 cm in diameter; irrigate the field after primary rotary tillage is completed, simultaneously, use rotary tillage machinery to carry out rotary tillage in the area that has been irrigated; rotary tillage of soil into mud can reduce water leakage and loss; the organic fertilizer is farmyard manure fermented from livestock manure, and the application amount is 2.8-3.2 tons per hectare;

B, transplant the seedlings when they have three leaves and one sprout, and transplant 2-4 seedlings per hill. The distribution of seedlings adopts the pattern of wide and narrow rows. The wide row spacing is 29-31% of the rice plant height in mature stage, the narrow row spacing is 17-19% of the rice plant height in mature stage, and the plant spacing is 14-16% of the rice plant height in mature stage;

C, before applying chemical fertilizer, determine the total amount of chemical fertilizer according to the expected yield. The amount of nitrogen, phosphorus and potassium contained in chemical fertilizer is equal to the amount of nitrogen, phosphorus and potassium taken away when the rice is harvested. The amount of nitrogen, phosphorus and potassium taken away by rice harvesting is calculated according to the biomass of rice straw and rice and the corresponding nitrogen, phosphorus and potassium content. For every 100 kg of rice harvested, straw and rice take away 1.50-1.66 kg of nitrogen, 0.353-0.391 kg of phosphorus and 1.405-1.553 kg of potassium.

D, implement deep application of chemical fertilizer during transplanting, wherein the application amount is 48-52% of chemical nitrogen fertilizer, 48-52% of chemical potassium fertilizer and 100% of chemical phosphorus fertilizer; when deeply applying chemical fertilizer, fertilize between rows by using a fertilizer application machine, and the fertilization depth is 4-6 cm; 7-9

days after transplanting, spread tillering fertilizer with 29-31% of chemical nitrogen and 48-52% of potassium fertilizers, and spread spike fertilizer with 19-21% of chemical nitrogen fertilizer when the heading rate reaches 48-52%; chemical fertilizer is urea, potassium chloride and NPK compound fertilizer; tillering fertilizer is chemical nitrogen fertilizer; ear fertilizer is chemical nitrogen fertilizer;

E, shallow water irrigation is carried out during the seedling stage and tillering stage, the depth of the water layer should be 2-3 cm; when approaching the end of tillering, the rice fields will be gradually dried at the end of tillering, and the ineffective tillering will be controlled. Then, alternate wetting and drying irrigation, when the soil shows signs of cracking, the paddy field should be irrigated, and the water depth should not exceed 10 cm when the field is irrigated and rewatered. Ensure that there is a water layer in the field at the period of panicle primordium differentiation and booting stage of rice. When irrigation water is scarce, the paddy field is irrigated and rewatered to keep the soil saturated. Before the rice matures, the field is gradually dried and harvested by machinery.

In step E, irrigation amount should be controlled during field drying in the late tillering stage and field drying in the mature stage. When there is too much rain, the field water will be discharged into the reservoir for reuse.

Through the above technical measures: firstly plowing and rotary tillage for pretreatment, and then irrigating and saturating the field to reduce water leakage in the field; in addition, alternate wetting and drying irrigation with shallow water reduces the leakage of field water and the evaporation of field water. At the same time, it promotes the growth of rice roots, which is beneficial to the absorption of nutrients; the wide and narrow row seedling distribution mode is convenient for mechanical deep application of base fertilizer; the deep application of base fertilizer can reduce fertilizer loss and prolong fertilizer efficiency.

Compared with the prior art, the invention has the following beneficial effects:

Through the wide and narrow row seedling distribution mode, it is convenient for mechanical deep application of base fertilizer. Deep application

of base fertilizer can reduce fertilizer loss, prolong fertilizer efficiency, and increase yield by 14% that is equivalent to saving fertilizer by 14%. The water management method of paddy field is improved, and water is saved by 23% through precise irrigation, and enable rice to be planted in areas with relatively scarce water resources. The method of the invention improves the fertilization mode and water management method of rice fields, and achieves the purpose of saving water and fertilizer.

BRIEF DESCRIPTION OF THE FIGURES

Fig. 1 shows a water-saving and fertilizer-saving rice planting method, which shows the distribution of wide and narrow rows of seedlings.

Wherein: 1- narrow row, 2- wide row, 3- plant spacing, 4- fertilization position.

DETAILED DESCRIPTION OF THE INVENTION

As shown in Fig.1, a rice planting method that saves water and fertilizer comprises the following steps:

A. evenly spread the rotten pig manure organic fertilizer in the field with an application rate of 3,000 kg/ha. Plowing the rice fields by using tractors to drive plowing pears; after plowing, the tractor drives the rotary tiller to perform the first rotary tillage on the paddy field, so that more than 90% of the clods are smaller than 5 cm in diameter. After the first rotary tillage, the field is irrigated; At the same time, the rotary tillage machinery is used in the irrigating area to perform rotary tillage in time to turn the soil into mud, so as to reduce the leakage and loss of water;

B. the seedlings are transplanted when they have three leaves and one sprout, and 3 seedlings are transplanted per hill; seedling distribution adopts the pattern of wide and narrow row 1, with wide row 2 spacing being 30%, narrow row 1 spacing being 18% and plant 3 spacing being 15% of the mature rice plant height; according to the data, the average plant height of rice at maturity is 116 cm, so the wide row 2 is set to 35 cm, the narrow row 1 is set to 21 cm, and the plant spacing 3 is 17 cm.

C. the expected yield of rice is 7,500 kg/ha, and the nutrient removal of rice and straw is 118.5 kg/ha of nitrogen, 27.9 kg/ha of phosphorus and 110.9

kg/ha of potassium. Therefore, the total application amount of chemical fertilizer is 120kg/ha nitrogen, 28kg/ha phosphorus and 110kg/ha potassium.

D. when transplanting, apply basal fertilizer and compound fertilizer of 420 kg/ha (containing nitrogen 63 kg/ha, phosphorus 28 kg/ha and potassium 52.3 kg/ha), and apply the fertilizer to the rice rows at fertilization position 4 with fertilization machine, the fertilization point is 5 cm away from the root system and the fertilization depth is 4-6 cm; on the 7th day after transplanting, tillering fertilizers, 74.3 kg/ha urea (containing nitrogen 34.2 kg/ha) and 110kg/ha potassium chloride (containing potassium 57.7 kg/ha), were applied. When the earring rate reaches 50%, ear fertilizer 49.6 kg/ha urea (containing nitrogen 22.8 kg/ha) was applied.

E. In the seedling stage and tillering stage, carrying out shallow water irrigation, and the depth of water layer is 2-3cm; near the end of tillering, stopping irrigation, so that the water in the paddy field is gradually drying. After 3 days of drying, the soil begins to show signs of cracking and irrigation begins; then, alternate wetting and drying irrigation is carried out. When re-irrigation is carried out in the field, the water depth is 4-5cm, and the field is naturally drying. When the soil shows signs of cracking, re-irrigation is started. There is water layer in the field during panicle primordium differentiation and booting stage; 7 days before the rice matures, the paddy field is no longer irrigated and gradually dries up.

Compared with the paddy field with conventional water management of flooding with mid-season drying, the irrigation water is decreased by 23%. Compared with the paddy field with equal fertilizer under conventional fertilization practice, the yield is increased by 14%, which is equivalent to saving fertilizer by 14%.

CLAIMS

1. A rice planting method that saves water and fertilizer, including the following steps:

A, before plowing, evenly spreading organic fertilizer in the field, and plowing the soil with a plowing machine; after the plowing is finished, the soil is preliminarily broken by rotary tillage machinery for the first time, so that more than 90% of the clods are smaller than 5 cm in diameter; after the first rotary tillage, irrigate the field, during which rotary tillage machinery is used to turn the soil into mud in the area irrigated in time; rotary tillage of soil into mud can

reduce water leakage and loss; the organic fertilizer is farmyard manure fermented by livestock manure, and the application amount is 2.8-3.2 tons per hectare; B, the seedlings are transplanted when they have three leaves and one sprout, and 2-4 seedlings are transplanted per hill. The distribution of seedlings adopts the pattern of wide and narrow rows. The wide row spacing is 29-31% of the rice plant height in mature stage, the narrow row spacing is 17-19% of the rice plant height in mature stage, and the plant spacing is 14-16% of the rice plant height in mature stage; C, before applying chemical fertilizer, determine the total amount of chemical fertilizer according to the expected yield, the amount of nitrogen, phosphorus and potassium contained in chemical fertilizer is equal to the amount of nitrogen, phosphorus and potassium taken away by rice harvest, and the amount of nitrogen, phosphorus and potassium taken away by rice harvesting is calculated according to the biomass of rice straw and rice and the corresponding nitrogen, phosphorus and potassium content; For every 100 kg of rice harvested, straw and rice take away 1.50-1.66 kg of nitrogen, 0.353-0.391 kg of phosphorus and 1.405-1.553 kg of potassium. D, deeply applying chemical fertilizer during transplanting, wherein the application amount is 48-52% of chemical nitrogen fertilizer, 48-52% of chemical potassium fertilizer and 100% of chemical phosphorus fertilizer; when deeply applying chemical fertilizer, applying fertilizer between rows by using a fertilizer application machine, and the fertilization depth is 4-6 cm; 7-9 days after transplanting, spreading tillering fertilizer with 29-31% of chemical nitrogen and 48-52% of potassium fertilizers, and spreading spike fertilizer with 19-21% of chemical nitrogen fertilizer when the heading rate reaches 48-52%; chemical fertilizer is urea, potassium chloride and NPK compound fertilizer; tillering fertilizer is chemical nitrogen fertilizer; ear fertilizer is chemical nitrogen fertilizer; E, shallow water irrigation is carried out during period of seedling establishment and tillering, the depth of the water layer is 2-3 cm; When approaching the end of tillering, the rice fields are gradually dried at the end of tillering, controlling ineffective tillering; Then, carrying out alternate wetting and drying irrigation, when the soil shows signs of cracking, the paddy field is irrigated, and the water depth is not more than 10 cm when the field is irrigated and rewatered; Ensure that there is a water layer in the field at the period of

panicle primordium differentiation and booting stage of rice. When irrigation water is scarce, the paddy field is irrigated and rewatered to keep the soil saturated. Before the rice matures, the field is gradually dried and harvested by machinery.

2. A rice planting method that saves water and fertilizer, according to claim 1, is characterized in that the chemical fertilizer is urea, potassium chloride and nitrogen, phosphorus and potassium compound fertilizer; the total amount of chemical fertilizer is equal to the amount of nitrogen, phosphorus and potassium taken away by rice harvest; the tillering fertilizer is chemical nitrogen fertilizer; the ear fertilizer is chemical nitrogen fertilizer.

3. A rice planting method that saves water and fertilizer, according to claim 1, is characterized in that the chemical fertilizer is urea, potassium chloride and nitrogen, phosphorus and potassium compound fertilizer; the total amount of chemical fertilizer is equal to the amount of nitrogen, phosphorus and potassium taken away by rice harvested; the tillering fertilizer is chemical nitrogen fertilizer; the ear fertilizer is chemical nitrogen fertilizer.

4. A rice planting method that saves water and fertilizer, according to claim 1, is characterized in that in the step E, irrigation amount should be controlled during drying in the late tillering stage and drying in the mature stage; when there is too much rain, the field water will be discharged into the reservoir for reuse.

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FIGURE

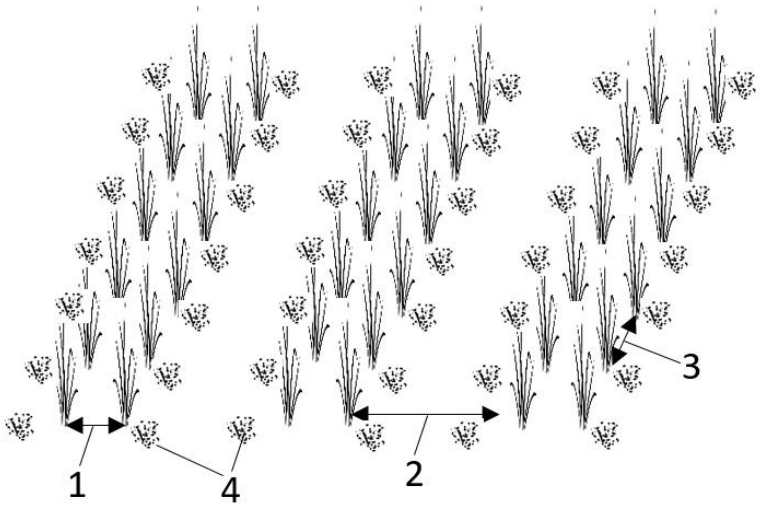

Figure 1

ABSTRACT

This invention provides a rice planting method that saves water and fertilizer, which comprises the following steps: A, before plowing, evenly spreading organic fertilizer in the field, plowing the soil with a plowing machine, and after plowing, using a rotary tiller to turn the soil into mud; B, the seedlings are transplanted when they has three leaves and one sprout, and the seedlings are distributed in wide and narrow rows; C, deeply applying base fertilizer, and applying chemical nitrogen fertilizer, chemical potassium fertilizer and chemical phosphorus fertilizer during transplanting, and applying fertilizer between rows by using fertilizer applying machinery; D, during period of seedling establishment and tillering period, carrying out shallow water irrigation, and near the end of tillering period, the rice fields are gradually dried at the end of tillering period to control ineffective tillering. When drying the fields, according to the water retention of the soil, on the premise of not affecting the filling of rice field, gradually drying the fields, and harvesting by machinery. The method is easy to operate, which reduces the amount of fertilizer application. Through the wide and narrow rows of seedlings distribution mode, it is convenient for mechanical deep application of basic fertilizer. Through deep application of basic fertilizer, the loss of fertilizer is reduced, and the efficiency of the fertilizer is prolonged.