News and Highlights

A New Extension of Geological Work: To Grow Rice in the Desert

HUANG Min, LIU Zhiqiang, LIU Lian, FEI Hongcai, ZHOU Jian, ZHANG Yuxu and HAO Ziguo*

Chinese Academy of Geological Sciences, Geological Society of China, Beijing 100037, China

For thousands of years, a large number of peripheral rivers have been flowing into deserts, the water from which then will infiltrate underground or evaporate into the air. When desert sand engulfs and humans retreat, precious freshwater resources lie dormant all the year round, making almost no contribution to human progress.

In recent years, Chinese geologists and agricultural experts have jointly and successfully grown rice in the desert fringe areas of China, which is a significant outcome for such a large country with 1.4 billion persons.

China is one of those countries with the most deserts in the world. These deserts are vast and cover thousands of kilometres in area, with an arc belt stretching over the northwest, north and northeast of China. This arc-shaped desert belt extends 600 km wide from north to south, and 4000 km long from east to west, with an area of more than 0.71 million km². Together with the Gobi Desert, the total area reaches up to 1.28 million km², accounting for 13% of the total land area of the country. The names and area of larger deserts in China are shown in Table 1.

These deserts are widely distributed in northwestern China. This area has an average sunshine intensity of $3\times10^6 \text{J/m}^2\text{s}$. Although the average annual evaporation is nearly 3000 mm and rainfall is generally only 100–400 mm, they all have rich freshwater resources. The deserts are basically connected to a plateau or mountains, such as the Tianshan, Kunlun and Qilian mountains, where mountain meltwater provides a rich water source. Most deserts have more abundant river systems, such as the Tarim, Yellow and Ejina rivers. And even in the depths of the deserts, there are still freshwater resources. This phenomenon has provided favorable conditions for planting rice in the deserts, which has turned an impossible thing into a reality.

In Shanshan County, Xinjiang, there is such a miracle. A desert rice technology demonstration field, close to the Hope Desert, is planted with glossy and green rice, which produces better rice quality and even better than that from its origin (Fig. 1). Similar desert rice planting areas also exist in Kulun Banner, Horqin Left Wing Rear Banner and Naiman Banner of the Horqin Desert of northern Tongliao City, Inner Mongolia. These desert areas are all adjacent to mountains or rivers, among which Shanshan County is close to the Tianshan and Tarim rivers and Tongliao is close to the Liaohe river basin, and groundwater resources are thus very rich. Horqin Left Wing Rear Banner is known as “the land of sand rice” in the Horqin Desert. This banner has an area of 0.3 million mu and an annual production of up to 0.15 billion kilograms of rice. Recently, Chinese researchers have successfully completed rice planting experiments in the Dubai Desert in the UAE, with a maximum yield of more than 500 kilograms per mu. In fact, as early as the 1990s, some places in Tongliao began to conduct desert rice planting tests. At present, the related technology has become very mature.

Why do we choose to grow rice with a great demand for water in deserts when deserts are dry? Originally, unlike traditional ideas, deserts are actually the best area for planting rice. The main advantages of desert planting are their natural organic and pollution-free environment, including the soil, air, water and temperature. For example, the temperature difference between day and night is great, and the accumulated heat in the Shanshan area, for instance, is up to 4500–5500°C, which can make the nutrient in rice become fully accumulated. Desert groundwater is mostly snow melt water from the Tianshan Mountains, which has a natural purity, weak alkalinity and no pesticides due to no weeds and no worms. In addition, the high silicon content in the desert area has correspondingly increased the trace elements in paddy rice.

Public data indicates that at present there are at least more than 300 million mu of cultivated deserts in China. There are two conditions to enable rice planting in deserts, i.e., abundant organic matter in the desert itself and groundwater resources. To grow desert rice, the most important thing is to solve the problem of large water leakage and evaporation in deserts. We can excavate deep pits in the deserts, and cover the bottom of the pits with special lining film (up to 80 cm thick), which can solve

* Corresponding author. E-mail: haoziguo@126.com

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Table 1 Names and area of the main deserts in China

<table>
<thead>
<tr>
<th>Desert name</th>
<th>Area (10^4 km²)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taklimakan Desert</td>
<td>33.76</td>
<td>Tarim Basin in Xinjiang</td>
</tr>
<tr>
<td>Badain Jaran Desert</td>
<td>4.90</td>
<td>Alxa Plateau in western Inner Mongolia</td>
</tr>
<tr>
<td>Gurbantunggut Desert</td>
<td>4.88</td>
<td>Junggar Basin in Xinjiang</td>
</tr>
<tr>
<td>Tengger Desert</td>
<td>4.27</td>
<td>Southeastern Alxa Plateau in Inner Mongolia</td>
</tr>
<tr>
<td>Horqin Sandy Land</td>
<td>4.23</td>
<td>West Liaochi river basin</td>
</tr>
<tr>
<td>Qaidam Desert</td>
<td>3.49</td>
<td>Qaidam Basin in Qinghai</td>
</tr>
<tr>
<td>Maowusu Desert</td>
<td>3.21</td>
<td>Southern Ordos Basin</td>
</tr>
<tr>
<td>Kumtag Desert</td>
<td>2.28</td>
<td>East Xinjiang, west Gansu, south Lop Nor, north Altun Mountains</td>
</tr>
<tr>
<td>Hulunbairake Sand Land</td>
<td>2.14</td>
<td>South Xilingol Grassland in Inner Mongolia</td>
</tr>
<tr>
<td>Kubuqi Desert</td>
<td>1.61</td>
<td>Northern Ordos Basin</td>
</tr>
<tr>
<td>Ulam Buh Desert</td>
<td>0.99</td>
<td>Northeast Alxa Plateau in Inner Mongolia</td>
</tr>
<tr>
<td>Hulunbeier Sandy Land</td>
<td>0.72</td>
<td>Southwestern Hulun Buir</td>
</tr>
</tbody>
</table>

In the early stage of planting rice, the self-developed patent technology of the anti-evaporation cover was adopted to reduce the evaporation of water vapor. When rice grows to a close crop, the evaporation is not large, which is favorable for rice growth. There is also a kind of anti-seepage red sand, which can bear about 40 tons of weight per m², and a layer of only 2 cm thick red sand can retain water and also guarantee the air permeability. With these technologies, rice in one mu of desert will only use about 400 m³ of water, which is even less than half of the local dry land corn and grape planting. Estimates suggest that the annual income of one mu of desert rice is about 2400 yuan, and the net income of mu after deducting costs is about 1900 yuan.

In the case of only 2.025 billion mu of cultivated land in China, such large or small paddy fields are scattered among the sand seas, which not only increases the cultivated land and grain but also effectively inhibits wind and sand loss. The development of agricultural geology has identified the occurrence and flow patterns of groundwater in desert areas, which has laid foundation for planting rice in desert areas.

Acknowledgement

Thanks are given to Susan TURNER, Brisbane, for her improvement of English.