

# International Joint Research on Applying Peat for Crop Cultivation in Desert

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## Introduction

Desertification is one of the world's most pressing environmental problems, directly affecting more than 100 countries. In China, desertification has also accelerated recently. According to China's Forestry Bureau, saline desert and semi desert covers 27.3% of China's land area.

Desert is a harsh zone for vegetation not only because of its severe weather conditions but also due to the poor quality of the soil. Desert soils are usually alkaline, deficient in organic matter, which holds the manure or fertilizers, and have a low water-holding capacity due to poor particle structures.

The Japan Peat Society (JPS), headed by Kohei Fujita, put forward an idea to ameliorate the quality of desertified land by utilizing the superior characteristics of peat. Originally, peat is an organic substance containing humic acids, which neutralize the alkaline desert soil, has an excellent water-holding capacity, which retains water in the soil, and can capture and hold manure or fertilizer.



Fig. 2: Research staff at the test field (Zhouqiong Wang second from left, Hiroshi Kawakami, middle and Shugang Li, right)

To realize the idea, a joint research project was undertaken between Japan and China at a desert in Xinjiang Uygur Autonomous Region (called Xinjiang), China from 1997 to 2000. The organizations in

practice were JPS, Japan and the Xinjiang Institute of Ecology and Geography (XIEG), China, supported by the Japan International Cooperation Agency (JICA) and The Chinese Academy of Sciences (CAS).

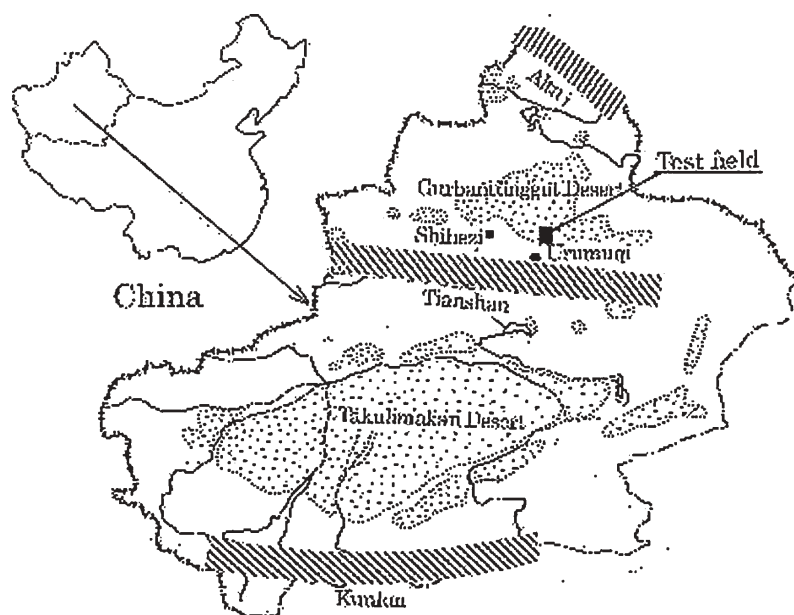


Fig 1: Map of Xinjiang Region in China showing mountains, deserts, cities and location of test fields.

## Place and research staff

Xinjiang lies in the west of China, bordering the countries of Central Asia and historically renowned for its Silk Road. The inhabitants consist of thirteen races. This region has the largest number of deserts in China.

Looking at the map (Fig. 1), you can find three big mountain ranges in Xinjiang. They are the Altai, Tianshan and Kunlun Mountains, from north to south. Between the Altai and the Tianshan Mountains there is the Gurbantunggut Desert, and the flat area between the Tianshan and the Kunlun Mountains is mostly occupied by the Takulimakan Desert, which is the second largest shifting desert in the world.

One site on the Gurbantunggut Desert was chosen as the place for our cultivation tests and a two hectare test field was established there. The site is situated at the southern edge of the desert, 90 km north of Urumuqi, the capital of Xinjiang. This desert is a sandy desert composed of fixed and half-fixed sand dunes. Dry resistant shrubs include *Tamarix*, *Haloxylon* and *Calligonum*, and the small amount of weeds barely survives.

Temperatures rise to 42 degrees °C in the summer and annual precipitation is only 160 mm. In such arid land, irrigation is necessary for cultivation. The irrigation water for the test field was obtained from underground sources. This area is on the northern piedmont of the Tianshan Mountains, which are 4,000

~ 5,000 meters above sea-level and covered with snow throughout the year. The melt waters from the mountains flow under the desert land and a well was dug to utilise this source for irrigation purposes.

The soil texture of the field was fine sand containing silt and clay; we call this soil "sand". The sand was highly alkaline with a low content of organic matter. Results of precise analysis showed, pH 9-10, electrical conductivity 0.2-0.3mS/cm, an index for cation concentration, organic matter 0.6% and a field moisture capacity of 21%.

The research staff (Fig. 2, 3 and 6) were researchers and engineers of JPS and XIEG. The Japanese staff stayed throughout the cultivation season, that

is, from March to November. Hiroshi Kawakami and Yasuo Niijima, managing directors, were the main staff and other specialized staff stayed for a few months as required. The Chinese staff had their homes in Urumuqi. Professors Shugang Li and Zhouqiong Wang were the leaders from China.

Through the weekdays, the research staff of both sides stayed together as a community in a camp near the test field, called Fukang station.

### **Peat and the effect of peat on the properties of desert soil**

For the cultivation tests, domestic peat produced in Shihezi was used. The cost of peat, especially its transportation cost, is the most significant for practical application of peat to desert. Shihezi is only 150 km west of Urumuqi and linked by a highway. In Shihezi, peat deposits, including small as well as large ones, are distributed over a 10 km x 8 km area. The thickness of the deposits is about one meter. Because the peatland was not yet commercially developed, the research staff and their workers dug up the peat themselves with the permission of the local government and transported it to Fukang station (Fig. 4).

Peat in China is mostly herbaceous and rich in ash content. Shihezi peat is also herbaceous and its ash content is in the range of 60-70%. In spite of a low content of organic matter, the humic acid content is high. Besides Shihezi peat, some Canadian sphagnum peat was also used for comparative tests.

In the field, the sand was tilled to a depth of 30 cm and the peat was mixed uniformly with sand in ratios of 2%, 5% and 8% by dry weight. After cultivation tests, the yields of each harvest were compared.

Besides these tests, the physical and chemical properties of the peat/sand mixes were determined. As expected, the properties of the sand were clearly improved by mixing with peat. Bulk density, hardness, ratio of solid phase in three phase distribution and pH decreased, and field moisture capacity and cation exchange capacity increased in proportion to the peat mix ratio. The effect of Canadian peat was greater than that of the Shihezi peat. In the field, the im-



**Fig. 3: Yasuo Niijima standing on top of an afforested sand dune.**



**Fig. 4: Digging out peat at Shihezi.**

provement of sand properties was not so clearly observed compared with that in pot tests.

### Harvest of crops cultivated on peat- mixed desert soil

Various crops such as corn, peanut, small cabbage and wheat were cultivated in desert soil mixed with peat in the above mentioned ratios, respectively and the harvests were compared with those in the plots untreated with peat. Areas of individual test plots were 200 sqm for wheat and 100 sqm for other crops. Urea and double super phosphate were used as fertilizers. Potassium was not applied because the sand was naturally rich in potassium. Irrigation was provided according to local customs.

Generally, yields of crops increased with increasing mix ratio of peat (Fig. 5). Peanut gave maximum yield in the plot with 5% peat over the four years, and the yield was 4-6 times greater than that of the plot untreated with peat. Corn gave nearly the same result as that of peanut. Small cabbage yield was 3-4 times greater than that in the plot untreated with peat and was also dependent on the amount of nitrogen fertilization. Yields of wheat were variable and the effect of peat was not confirmed.

Besides crop cultivation, trees and shrubs such as *Tamarix*, *Haloxylon*, *Calligonum*, *Ulmus* and *Populus* were planted on sand dune and plain. *Tamarix* and *Haloxylon* grew well on the sand dune even without irrigation.

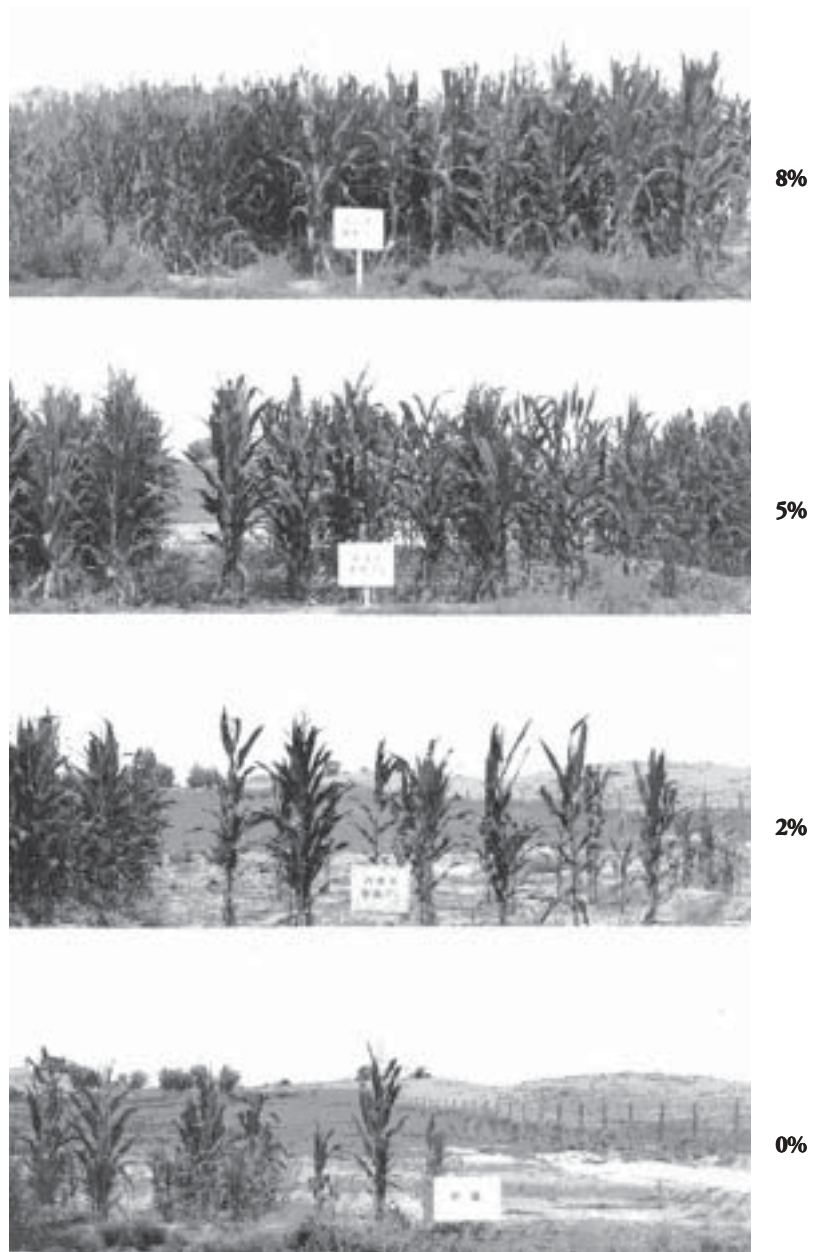


Fig. 5: Comparative growth of corn at various peat/sand ratios.



Fig. 6: Working at the test fields.

### Other projects

The joint research was successfully finished in 2000 and the advantage of peat for improving the property of sand and for acquiring better harvests in desert was proved.

Besides Xinjiang, JPS had another project on the cultivation of paddy rice in the desert in the Ningxia Huizu Autonomous Region from 1999 to 2000. This was carried out in cooperation with CAS and obtained better results in the field test than the best yield of paddy rice in Japan.

Further, JPS is researching the effect of peat on soil conservation and shrub growth in Gansu Province, China in co-

operation with CAS. This project is now progressing successfully. JPS has also had experience in utilising peat for planting shrubs for sheep farming in the Syrian steppe. This was done in cooperation with the Syrian government.

JPS is striving for the reclamation of desert and desertified land by utilizing the superior characteristics of peat. ■

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