タイ王国コンケン県における生物的塩類利用システムの導入
Implementation of the Biological Salt Utilizing System in Khon Kaen Thailand

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1. Introduction

Saline soils cover 8% of the world's irrigated area. Salinization of agricultural lands is a problem that has not yet been fundamentally solved, and research is continuing around the world. Research on salinization has been conducted since the 1950s, and by 1990, FAO and the American Society of Civil Engineers (ASCE) had published a text on agricultural salinity assessment and management (e.g., ASCE, 1990), and the basic research was almost complete.

Since the year 2000, research on irrigation and drainage systems to manage salts discharged from agricultural lands has been actively conducted in the United States and Australia, the leading irrigation countries. The most advanced are Sequential Biological Concentration (hereafter SBC) systems, in which crop cultivation and wastewater reuse are repeated to concentrate and dispose of salts (Ayars, 2014; Brackwell et al., 2005). SBC systems are limited in their implementation because they require facilities and equipment such as culverts, filtration systems, and solar evaporators, as well as large tracts of farmland (100 ha to 1000 ha).

The authors are promoting salt removal through drainage improvement and cultivation of salt-tolerant crops in research plots in Khon Kaen Province, Thailand, using the concept of the SBC system as an aid. In addition, a survey and workshop for resource utilization of high-salinity wastewater for salt production has been conducted and a salt management and utilization system including salt production is being introduced (Kume et al., 2019). In the target area of Khon Kaen Province, the average landholding is only 2-3 ha, and the area is not economically affluent. Therefore, the implementation of the SBC system itself is difficult. For adaptive salt management in the local area, it is necessary to develop and improve a system that can be diffused in the area, based on an understanding of the local characteristics and realities. This presentation reports on the outline of the authors' research on the biological salt utilization system in Khon Kaen Province and attempts to share information on the conservation of saline soils.

2. Reserach area

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In Northeast Thailand, approximately 17% of the total area of 169,000 km^2 is affected by salinization. The province is located in the interior of Thailand, and there are no major rivers or oceans in the vicinity to discharge salts outside the district. Therefore, the removal of salt from the area requires a large network of drainage channels that cross the provincial border, which is impractical. The province has a wide range of flat terrain, and the existence of many poorly drained areas is another reason for the lack of progress in resolving salinization. Here, rice is cultivated with rainwater during the rainy season (May-October), and vegetables (tomatoes, peppers, pumpkins, etc.) are grown using water from reservoirs during the dry season (November-April).

3. Biological Salt Utilizing System

The biological salt utilization system introduced by the authors in Khon Kaen Province is a system in which a drainage channel is excavated in the center of the target area and de-salinization is carried out from upstream to downstream while rice cultivation, cultivation of salt tolerant crops, and production of table salt are carried out according to salinity. The advantage of this system is that it does not require the construction of a network of drainage channels outside the district, and salinity can be managed on a farmhouse basis (2-3 ha). The system consists of a reservoir, drainage channels, and evaporation ponds. Drainage is encouraged from upstream to downstream of the system to remove salt and cultivate salt-tolerant crops, and the high-salt drainage removed downstream of the system is used for salt production. To reduce soil salinity, a drainage channel was excavated in April and May of 2019. Salt has been discharged from upstream to downstream, and table salt will be produced in the traditional way using concentrated brine in the evaporation reservoir. The water in the reservoir is used to grow salt-tolerant crops while facilitating salt removal. Thus, the system aims to increase farmers' cash income through salt removal by drainage channels, salt production using the removed salt, and cultivation of salt-tolerant crops.

4. Saline soil management by the system

This research aims to complete a system that enables salt management primarily through drainage improvement, salt-tolerant crop cultivation, and salt utilization through traditional table salt production at the farm household level. By adding utilization to salt management, various innovations and indigenous knowledge of farmers themselves will be created. By elaborating and applying them scientifically, conservation of saline soils will be more adaptive to social and natural changes. In the future, we plan to examine how the system should respond to various changes from the viewpoint of adaptive governance.

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