Salinity Dynamics in Salt-damaged Area due to Drainage channel excavation
排水路掘削による塩害地の塩分動態

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1. Introduction

Agriculture is the primary industry in northeastern Thailand, but soil salinization is a severe problem. In this region, salinization is progressing and expanding due to the existence of a rock salt layer called the Mahasarakam Formation, as well as human activities such as deforestation (T. Pipatpongsa et al., 2007; Yoshinaga and Hamada, 2007).On the other hand, large-scale drainage canals have not been developed in this area, and rainfall during the rainy season does not effectively leach soil salinity sufficiently. Consequently, areas with severe salt damage have been abandoned. Restoring and utilizing salt-damaged farmland is essential to ensure future food supply.

This study investigated the spatial and temporal variations in soil salinity distribution in fields where small-scale drainage canals were excavated. We examined the effects of drainage improvements on soil salinity leaching and assessed future challenges.

2. Methodology

We have conducted field research since 2018 in Ban Phai, Khon Kaen Province, Northeast Thailand (Fig.1). This field (~2.85 ha) had been abandoned because of strong soil salinization. In April 2019, the drainage channel and ditch were excavated in the center and around the western part of the field to remove saline through drainage improvement. With the drainage channel and ditch excavation, salinity in the field tended to decrease (Nohara et al., 2020). However, since September 2019, most current drainage channels have accumulated sediment because of heavy rain and reduced maintenance. Moreover, salinity reaccumulating started occurring. As a countermeasure, the drainage channels were dredged and improved in January 2024.

ECa at each depth range (V: 0-1.50 m, H: 0-0.75 m) was measured using an electromagnetic induction instrument (EM38-MK2, GEONICS limited). All measurement sites were located using GPS. An ECa map was created by loading the ECa data with location information into QGIS and interpolating the ECa data using a triangulated irregular net network method.

Fig.1 Outline of the study area

3. Results and discussion

Even if the amount of salt in the soil is the same, ECa varies depending on soil moisture, so it is difficult to compare

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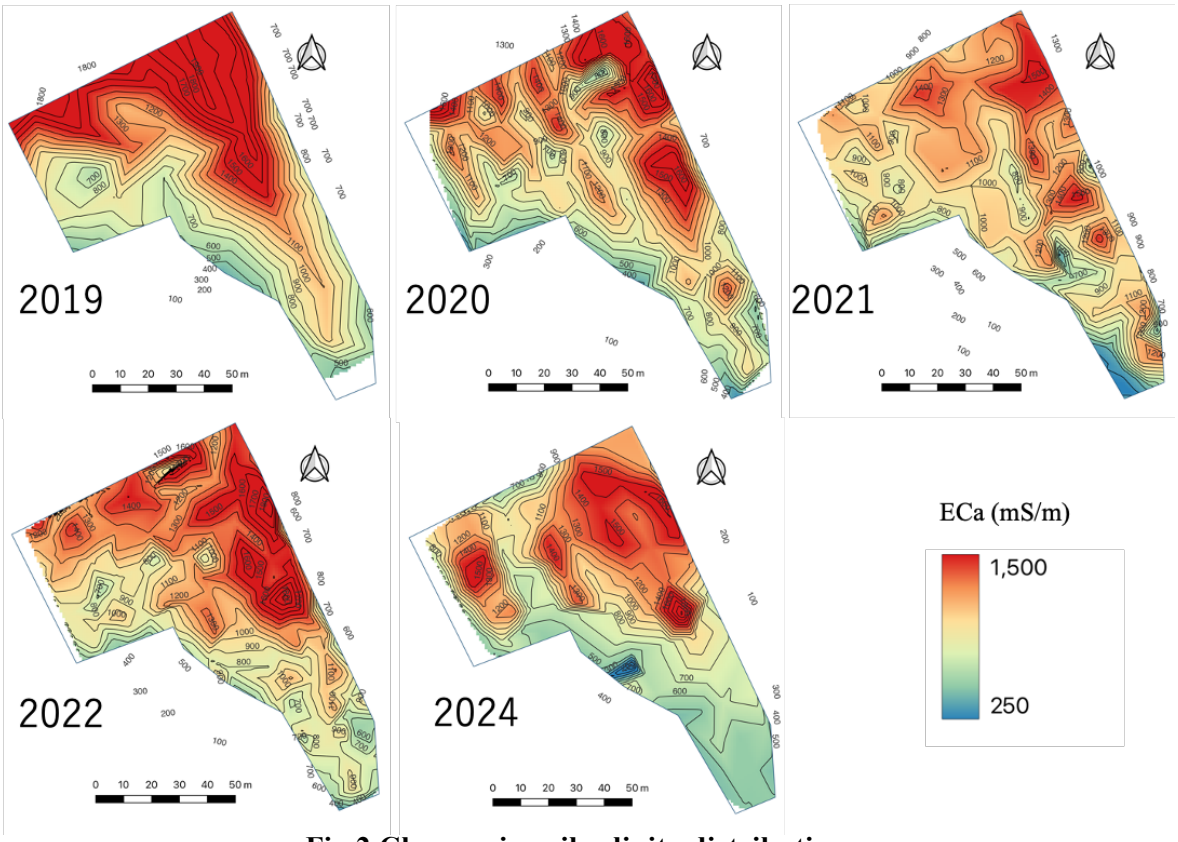

Fig.2 Changes in soil salinity distribution

observed values in the rainy and dry seasons directly. Therefore, we will compare changes over time using values measured in March each year from 2019 to 2024 (2023 is missing). **Fig.2** shows the change in ECa distribution in the 0-0.75m range. In 2019, before the drainage canal was excavated, it was observed that ECa tended to be higher downstream. A month later, a drainage canal was excavated, and about a year later, in 2020, the area showing high values decreased.

Furthermore, in 2021, the ECa values decreased overall, and this trend was especially noticeable in the western area surrounded by drainage canals. After that, in 2022, the values rose again, mainly on the east side of the field. This is because the precipitation in August and September since 2019 has been higher than the climatological normal, and the salinity leaching effect has decreased due to sediment inflow into the drainage canals. In 2024, ECa values declined in the upstream region after the redevelopment. Although there has been no rainfall since the redevelopment, since the value has decreased, the redevelopment has accelerated the decline in the groundwater level and progressed in salinity leaching.

4. Conclusion

The results of this study confirmed that in areas with separate rainy and dry seasons, salt removal effects were confirmed even in small drainage canals on flat terrain where the drainage capacity was (thought to be) insufficient. Such drainage canals can be excavated even at the farmer's level. As long as they are properly maintained, this technology can be applied to areas with similar climate and land conditions that suffer from salt damage.

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