（学位第３号様式）

学 位 論 文 要 旨

氏　名	Yuta Hirashima
題　目	Application of advanced sensing technology to measure soil moisture and electrical conductivity (土壌中の水分・電気伝導度計測に対する先端センシング技術の応用)

Despite the development of various advanced sensing technologies for understanding the dynamics of soil moisture and electrical conductivity, their social implementation has been limited. This research applied advanced sensing technologies to areas at risk of salinity damage in reclaimed agricultural land and areas at risk of sediment disasters on volcanic ash slopes. We established techniques for observing the electrical conductivity (EC) of water in clay soils and estimated the spatial representative values of soil moisture based on observations of epithermal neutron count rate. The key findings are as follows:

1) In reclaimed agricultural land with potential risk of salinity damage, we explored a new simultaneous measurement method for volume water content, matric potential, soil water EC, and osmotic potential of clay soils using a TDT sensor. Laboratory drainage experiments using topsoil as test soil revealed the empirical relationship between the dielectric constant, volumetric water content, and bulk EC of reclaimed land soil. It was found that moisture and salt stress exceeding the growth inhibition point of topsoil could occur regularly during summer. Additionally, the EC of the saturated extract at 15 cm and 25 cm depths under the plastic film in an onion cultivation field was found to be at a level that could reduce the relative yield of onions.

2) To clarify the effectiveness of COSMOS as a method for observing surface soil moisture in reclaimed agricultural land, we observed the temporal changes of thermal neutron numbers using COSMOS at a test field with installed TDT sensors. Analysis of the response to volume water content measured by TDT sensors revealed a clear negative response of corrected epithermal neutron count rate. In reclaimed agricultural land with shallow groundwater and poor drainage, the variability of epithermal neutron count rate in response to changes in volumetric water content was significant, indicating that hourly observations are unsuitable, requiring relatively long observation spans of about one day.

3) COSMOS and TDT sensors were installed on volcanic ash slopes affected by sediment disasters to conduct continuous observations of epithermal neutron count rate and soil moisture. During the rainy season from June to September, the average value of the volumetric water content measured by the TDT sensors showed a significant increase, while the epithermal neutron count rate inversely decreased. Calibration was performed by limiting the observation period, which resulted in improved observation accuracy. The limited-period calibration of COSMOS indicated the potential to detect the response of volumetric water content over shorter spans than previous studies in reclaimed agricultural land, and it was revealed that the volumetric water content observed by COSMOS showed more gradual changes compared to that measured by TDT sensors.