3D MAP IN THE DEPTH DIRECTION OF FIELD FOR PRECISION AGRICULTURE

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ABSTRACT

This study aims to establish an agricultural support system with advanced agricultural knowledge and technology that can support for any production area or varieties using IT. In this study, we investigated the availability of soil information collected using the soil moisture sensor to create the 3D map in the depth direction on citrus slope field. In addition, we developed a specification of the soil sensing system for slope field because there are many restrictions sensing of soil in the slope field. After this study, soil information in the direction on slope field can be represented in 3D map. Moreover, it is considered that the 3D map can be used as an index of the irrigation program.

Keywords: Soil information, 3D map, Depth direction, Mapping, Slope field

INTRODUCTION

By a change in eating habits with economic development and the global population growth, we have been faced with the need for increased food production again. In order to solve the food problem in the future, the introduction

of agriculture organization is progressing in emerging countries as well as developed countries. However, the occurrence of natural disasters and abnormal weather, which is becoming a worldwide problem at present, is further weakening the crops of farm products. These phenomena have been difficult to make the production of high-quality sustainably only corporate agriculture management. In this study, we investigated the availability of the soil information collected using the soil moisture sensor to create the 3D map in the depth direction on citrus slope field so that making support system for precision agriculture.

MATERIAL AND METHODS

The research data were collected from the citrus field on December 12, 2013 in a 0.0012ha experimental field in Ehime prefecture (west of Osaka Japan). Also, the citrus cultivar that are grown mainly is Harehime. We set the condition that the soil information was collected 100mm away from the tree, and 0mm, 200mm and 400mm below the soil surface. In order to collect the soil information, the soil moisture sensor (GS-3, Decagon Devices Inc.) were used. The number of the soil information had been collected by 138 points. This time, soil components had been measured are volume water content, electric conductivity and soil temperature. We created the 3D map after the soil components with location data had been collected. Location data (that is included latitude, longitude and altitude) was collected by using the GPS receiver (Hyper II, TOPCON). The 3D map was created by using Arc GIS 10 (ESRI). In order to create the 3D map, it is adopted IDW (Inverse distance weighting) is a method of spatial interpolation. After created the 3D map, we validated the correlation between the soil information and the citrus yield.

RESULT AND DISCUSSION

In the result of the experiment, volume water content increased as soil depth become deeper. Additionally, electric conductivity indicated a similar pattern as volume water content. However, soil temperature became low as soil depth become deeper. The relationship of the soil information and the citrus yield was investigated. As a result, it was recognized that each of the soil components at a depth of 400mm had the highest correlation with the citrus yield. Moreover, it was found a negative correlation between the soil information and the citrus yield.

After this study, soil information in the direction on slope field can be represented in 3D map. Moreover, it is considered that the 3D map can be used as an index of the irrigation program for increased productivity.