ALCOR and ALJARAFE MODELS APPLICATION FOR EXPLORING THE AGRO-ECOLOGICAL LIMITS of SUSTAINABILITY in AHAR AREA (IRAN)

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Abstract

Sustainable agriculture development is the main aim in crop land management. It can be achieved through the simultaneous prediction of land suitability and land vulnerability. Within the new framework of MicroLEIS DSS, Soil Engineering and Technology Prediction Models named Alcor and Aljarafe were developed and validated in Spain as a Mediterranean region to evaluate the land vulnerability. Because of soil data range similarity for the study area and originated one in the models, they can be applied and the results will be with high accuracy. Soil morphological and analytical data were collected from 44 representative soil profiles of the total study area of 9000 ha, which has located in the east Azerbaijan province of Iran (Ahar). Soil database multilingual plus (SDBm +) was used to enable the storage and retrieval of soil profile data in a quick, efficient and systematic way. Alcor model results under current land management system showed that 30 ha, 703 ha, 6500 ha, 1343 ha and 257 ha of the total lands were classified as very low, low, moderate, high and very high vulnerable respectively which often redundantly from soil compaction. Also between studied soils, Typic Xerorthents was the most sensitive soils. According to Aljarafe model, optimum moisture for working on soils are calculated between 10% - 20% and 20% - 30% in 3422 ha and 5411 ha of the studied area. Therefore, concerning the obtained results can be led to sustainable agriculture development.

Key words: Alcor, Aljarafe, MicroLEIS DSS, compaction, optimum moisture, sustainability

Introduction

Engineering and Technology prediction models named Alcor and Aljarafe were developed to evaluate the land vulnerability caused by soil compaction, optimum moisture and plasticity index, respectively. They were formulated and calibrated by using basic information from North Europe soils, and validation test with good results was developed for Mediterranean conditions (De la Rosa et al, 2002). Because of soil data range similarity for the study area and originated one in the models, they can be applied and the results will be with high accuracy (Shahbazi, 2008 a). It is interesting to predict the mechanical soil strength or mechanical sensitivity of soils, in order to prevent damage to soil physical properties by tillage and traffic. The compaction risk or vulnerability of agricultural soils, measured by the pre-compression stress, can be used to give recommendations for site adjusted farming techniques (Horn et al, 2002). On the other hand, optimum water content for workability is equal to the water content at maximum Proctor density. Therefore, soil workability can be defined as the optimum water content at which agricultural tillage produces the great proportion of small aggregates. If the soil is tilled when it is wetter that this optimum water content, then large clods can be produced and soil structural damage can occur. If the soil is drier that the optimum water content, then tillage requires excessive energy and can also produce large clods (Rounsevell and Jones, 1993; Dexter and Bird, 2001).

Materials and Methods

This study was performed in Ahar province of East Azarbaijan, Iran, (Fig. 1) which has different kind of land use associated with different parent material such as limestone, old alluvium and volcano-sedimentary rocks. It is about 9000 ha and is located between $47^{0}00'00''$ to $47^{0}07'30''$ east longitude and $38^{0}24'00''$ to $38^{0}28'30''$ north latitude. Soil morphological and analytical data were collected from representative 44 soil profiles and stored in SDBm plus (shahbazi, et al, 2008 b). Clay content, cation

exchange capacity and organic matter content are soil data to run the Aljarafe model to calculate the plasticity index and optimum moisture of soils which can be appropriate for working. Clay, silt and organic matter as weight percent and soil stoniness, total porosity, field capacity and wilting point expressed as volume percent are the whole data entrance in Alcor model to predict the most suitable machinery type. The management data has a relationship with the soil data of one to one through the corresponding "field-unit". Finally, GIS tool has applied to create geo-referenced thematic maps according to models outputs.

Results and Discussions

Alcor model results under current land management system showed that 30 ha, 703 ha, 6500 ha, 1343 ha and 257 ha of the total lands were classified as very low, low, moderate, high and very high vulnerable respectively which often redundantly from soil compaction. Also between studied soils, Typic Xerorthents was the most sensitive soils. (Fig. 1).

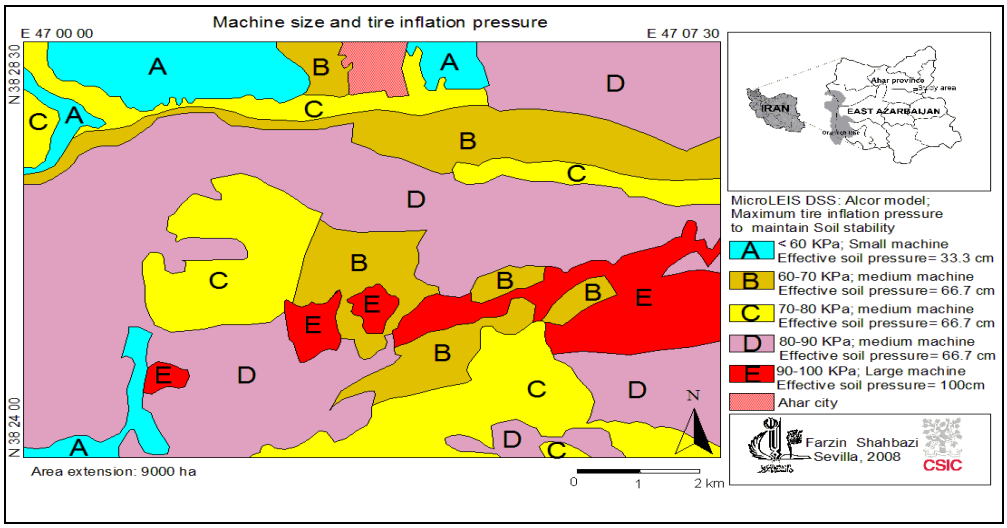

Fig.1- Trafficability classification of studied soils

According to Aljarafe model, optimum moisture for working on soils are calculated between 10% - 20% and 20% - 30% in 3422 ha and 5411 ha of the studied area. Therefore, concerning the obtained results can be led to sustainable agriculture development.

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