Journal of Integrative Agriculture 2016, 15(10): 2417–2425

Available online at www.sciencedirect.com

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RESEARCH ARTICLE

Linking a farmer crop selection model (FCS) with an agronomic model (EPIC) to simulate cropping pattern in Northeast China

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Abstract

In this paper, authors established a farmer crop selection model (FCS) for the three provinces of Liaoning, Jilin and Heilongjiang of the Northeast China. With linking to the environmental policy integrated climate model (EPIC), the simulated results of FCS model for maize, rice and soybean were spatialized with 1 km×1 km grids to obtain cropping pattern. The reference map of spatial distribution for the three staple crops acquired by remote sensing imageries was applied to validate the simulated cropping pattern. The results showed that (1) the total simulation accuracy for the study area was 78.62%, which proved simulation method was applicable and feasible; (2) simulation accuracy for Jilin Province was the highest among the three provinces with a rate of 82.45% since its simple cropping system and not complex topography; (3) simulation accuracy for maize was the best among the three staple crops with a ratio of 81.14% because the study area is very suitable for maize growth. We hope this study could provide the reference for cropping pattern forecasting and decision-making.

Keywords: cropping pattern, staple crops, EPIC model, FCS model, simulation

1. Introduction

Because changes in land use and land cover are important signs of alterations to the earth's surface as a result of human activities, such changes have become a focus of geoscience research since the 1990s (Turner II *et al*. 1995; Lambin *et al*. 1999; IGBP 2001). Agriculture is a productive activity that is most closely related to land use by humans, and agricultural land use reflects pattern and extent of human impact on natural ecosystems at a landscape scale (Tang *et al*. 2004). The spatial pattern of crops in farmland ecosystems includes composition, spatial distribution of crops, multiple cropping or fallow cultivation, and rotation systems (Liu and Deng 2010); this pattern provides a spatial representation of human utilization of agricultural production resources and forms the basis for simulation studies on changes in the spatial structure of crops and potential adjustments and optimization of crop structures (Yin *et al*. 2006; Frondoni *et al*. 2011). Thus, it is very important to conduct research on simulation of spatial pattern and its changes.

Simulations of spatial pattern of crops must address the "human-environment relationship". In the geosciences, the current research methods to determine this relationship can be divided into two categories: top-down methods and bottom-up methods (Parker *et al*. 2003; Verburg 2006). The top-down methodology focuses on spatial statistical units of

Received 26 October, 2015 Accepted 13 November, 2015
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doi: 10.1016/S2095-3119(15)61247-3