

## Spatializing Growth Suitability for Spring Soybean Cultivation in Northeast China

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### ABSTRACT

In this paper, an integrated indicator-based system is established to map the suitability of spring soybean cultivation in northeast China. The indicator system incorporates both biophysical and socioeconomic factors, including the effects of temperature, precipitation, and sunshine on the individual development stages of the spring soybean life cycle. Spatial estimates of crop suitability derived using this indicator system are also compared with spring soybean planting areas to identify locations where there is scope for structural adjustment in soybean farming. Results of this study indicate that northeast China is moderately suited to spring soybean cultivation. Areas classified as suitable, moderately suitable, and unsuitable for soybean cultivation, respectively, occupy approximately  $9.09 \times 10^4$ ,  $11.45 \times 10^4$ , and  $7.99 \times 10^4$  km<sup>2</sup>, accounting for 11.5%, 10.11%, and 14.49% of the total area of northeast China. The Songnen and Sanjiang Plains are identified as the most and least suitable places, respectively, for spring soybean growth. A comparative analysis indicates that the suitable, moderately suitable, and unsuitable areas account for 24.78%, 46.30%, and 28.92%, respectively, of the total area presently under soybean cultivation. The analysis suggests that soybean cultivation in Heilongjiang Province is generally unfavorable, with equivalent percentages of 15.39%, 51.70%, and 32.91%. Results suggest that agricultural structural adjustment may be required to encourage farmers to grow spring soybeans. It is anticipated that this study will provide a basis for follow-up studies on crop cultivation suitability.

### 1. Introduction

China is the fourth-largest soybean producer in the world after the United States, Brazil, and Argentina (Kou and Feng 2008, 4–6). The total area of soybean growth and production reached nearly  $9 \times 10^6$  ha and more than  $16 \times 10^6$  t, respectively, based on data from China's Bureau of Statistics. As a consequence, fluctuations in soybean growth area and production in China have a large impact on the world supply and price of

edible oil and soybeans (Yang et al. 2010). Although soybeans are extensively cultivated across China (Yang et al. 2006, 12–14), approximately 50% of the total area of soybean cultivation in China is located in the northeastern part because of its high productivity (Zhao et al. 2003; Wei et al. 2007). For this reason, we selected northeast China as the study area in this paper.

In the past 30 yr, data from China's Bureau of Statistics have indicated that the total area and production of spring soybean in northeast China has been steadily increasing. In 1980, the total planted area and production amounts were  $265.94 \times 10^4$  ha and  $334.49 \times 10^4$  t, respectively. By 2009, those numbers reached  $460.93 \times 10^4$  ha and  $703.89 \times 10^4$  t. Farmers appeared to have expanded the planting area of spring soybeans into highly

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