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RESEARCH ARTICLE

Assessment of the contribution percentage of inherent soil productivity of cultivated land in China

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Abstract

The contribution percentage of inherent soil productivity (CPISP) refers to the ratio of crop yields under no-fertilization versus under conventional fertilization with the same field management. CPISP is a comprehensive measure of soil fertility. This study used 1 086 on-farm trials (from 1984–2013) and 27 long-term field experiments (from 1979–2013) to quantify changes in CPISP. Here, we present CPISP3 values, which reflect the CPISP states during the first three years after site establishment, for a series of sites at different locations in China collected in 1984–1990 (the 1980s), 1996–2000 (the 1990s), and 2004–2013 (the 2000s). The results showed that the average CPISP3 value for three crops (wheat, rice, and maize) was 53.8%. Historically, the CPISP3 in the 1990s (57.5%) was much higher than those in the 1980s (50.3%), and the 2000s (52.0%) ($P \leq 0.05$). Long-term no-fertilization caused CPISP levels to gradually decline and then stabilize; for example, in a mono-cropping system with irrigation, the CPISP values in Northwest and Northeast China declined by 4.5 and 4.0%, respectively, each year for the first ten years, but subsequently, the CPISP values stabilized. In contrast, the CPISP for upland crops in double-cropping systems continued to decrease at a rate of 1.1% per year. The CPISP for upland-paddy cropping decreased very slowly (0.07% per year), whereas the CPISP for paddy cropping decreased sharply (3.1% per year, on average) for the first two years and then remained steady during the following years. Therefore, upland crops in double-cropping systems consume the most inherent soil productivity, whereas paddy fields are favourable for maintaining a high level of CPISP. Overall, our results demonstrate a need to further improve China's CPISP3 values to meet growing productivity demands.

Keywords: crop yield, inherent soil productivity, typical cropping system, planting years, crop species

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1. Introduction

China is the world's most populous country with 1.3 billion people, and soil plays an important role in food security for the whole country. Although accounting for only 10% of global farmland, China feeds 20% of the world's population (Wu *et al.* 2018). To meet this challenge, over 30% of global chemical fertilizers (200 Tg per year) are used in agricultural