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RESEARCH ARTICLE

# Long-term organic and inorganic fertilizations enhanced basic soil productivity in a fluvo-aquic soil

**ZHA Yan[1], WU Xue-ping[1], GONG Fu-fei[1], XU Ming-gang[1], ZHANG Hui-min[1], CHEN Li-ming[2], HUANG Shao-min[3], CAI Dian-xiong[1]**

[1] *National Engineering Laboratory for Improving Quality of Arable Land, Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing 100081, P.R.China*

[2] *School of Environment and Natural Resources, The Ohio State University/Ohio Agricultural Research and Development Center, Wooster, Ohio 44691, USA*

[3] *Institute of Plant Nutrition, Resources and Environment, Henan Academy of Agricultural Sciences, Zhengzhou 450002, P.R.China*

**Abstract**

The improvement of soil productivity depends on a rational input of water and nutrients, optimal field management, and the increase of basic soil productivity (BSP). In this study, BSP is defined as the productive capacity of a farmland soil with its own physical and chemical properties for a specific crop season under local field management. Based on 19-yr data of the long-term agronomic experiments (1989–2008) on a fluvo-aquic soil in Zhengzhou, Henan Province, China, the decision support system for agrotechnology transfer (DSSAT ver. 4.0) crop growth model was used to simulate yields by BSP of winter wheat (*Triticum aestivium* L.) and summer maize (*Zea mays* L.) to examine the relationship between BSP and soil organic carbon (SOC) under long-term fertilization. Five treatments were included: (1) no fertilization (control), (2) nitrogen, phosphorus and potassium fertilizers (NPK), (3) NPK plus manure (NPKM), (4) 1.5 times of NPKM (1.5NPKM), and (5) NPK plus straw (NPKS). After 19 yr of treatments, the SOC stock increased 16.7, 44.2, 69.9, and 25.2% under the NPK, NPKM, 1.5NPKM, and NPKS, respectively, compared to the initial value. Among various nutrient factors affecting contribution percentage of BSP to winter wheat and summer maize, SOC was a major affecting factor for BSP in the fluvo-aquic soil. There were significant positive correlations between SOC stock and yields by BSP of winter wheat and summer maize ($P$<0.01), and yields by BSP of winter wheat and summer maize increased 154 and 132 kg ha$^{-1}$ when SOC stock increased 1 t C ha$^{-1}$. Thus, increased SOC accumulation is a crucial way for increasing BSP in fluvo-aquic soil. The manure or straw combined application with chemical fertilizers significantly enhanced BSP compared to the application of chemical fertilizers alone.

**Keywords**: soil organic carbon, basic soil productivity, long-term fertilization, DSSAT model, fluvo-aquic soil, wheat-maize rotation

## 1. Introduction

The improvement of soil productivity depends on a rational input of water and nutrients, optimal field management, and the increase of basic soil productivity (BSP). We define BSP as the productive capacity of a farmland soil with its own physical and chemical properties for a specific crop season

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Correspondence WU Xue-ping, Tel: +86-10-82108665, Fax: +86-10-82109742, E-mail: wuxueping@caas.cn; XU Ming-gang, Tel: +86-10-82105636, E-mail: xuminggang@caas.cn


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