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## Factors Affecting Fertiliser Use Efficiency in Apple Production in Northern China

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### Abstract

The widespread use of fertiliser has greatly contributed to the huge increases in agricultural production in China. China is now the world's largest producer and consumer of fertiliser, consuming over one-third of the world's fertiliser. However, Fertiliser use faces severe problems of overuse and low efficiency. The inefficient use of fertiliser has generated negative environmental consequences, including greenhouse gas emissions, non-point source pollution, the degradation of soil and water quality. As people's living standard improves, the demand of high value agricultural products, such as vegetables and fruits, has increased. Overuse of fertiliser has expanded from grain crops to cash crops since 1990. In recent years, excessive fertilisation in cash crops becomes more severe.

In this paper we aim to investigate the countermeasures to improve fertiliser use efficiency of apple growers in China. Stochastic frontier analysis is used to estimate the technical and fertiliser use efficiency of apple production based on a survey held among 908 households in four major apple growing provinces in China, namely Shandong, Liaoning, Shaanxi and Shanxi. Subsequently, Tobit model is applied to analyse factors influencing fertiliser use efficiency. The average technical efficiency and fertiliser use efficiency in 2016 were 0.78 and 0.43 respectively. On average, apple production is efficient, but fertiliser use efficiency has large space to improve. Results of the regression analyses explaining fertiliser use efficiency indicate that technical training, population structure of household, access to irrigation, per capita farm size and the price of fertiliser have a significant positive effect on fertiliser use efficiency. Whereas, household population structure, planting experience and special experience have positive effects on pure technical efficiency. Policies aimed at improving fertiliser use efficiency may therefore focus on strengthening the infrastructure especially the construction of orchard irrigation facilities, encouraging farmers to participate in environment and fertiliser management training program, as well as improving extension services.

**Keywords:** Apple production, China, fertiliser use efficiency, stochastic frontier production function