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Balanced Fertilisation and Productivity in Indian Agriculture

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Abstract

The adoption of modern inputs in developing agricultures, particularly in SSA, has been a major issue in the development literature. In large Asian agricultures such as India and China, the use of chemical fertilisers has been largely adopted (and used in substantial amounts), but agricultural productivity is still low compared to developed countries. After boosting agricultural productivity in India during the Green Revolution, in the last two decades additional increases in the use of fertiliser have not produced a similar increase to crop yield. This provides a major concern to policy makers in the areas of food security and farmer welfare. One possible explanation is an unbalanced and inefficient use of the fertilisation nutrients. Nitrogen fertiliser (urea), provided at a government set price, is vastly used by Indian farmers. A substantial portion of plots receive nitrogen treatment only.

When used in quantities not absorbed by plants, excess nitrogen contributes to groundwater pollution, while not contributing (and possibly harming) productivity. Unbalanced fertilisation practices also cause depletion of the other soil nutrients, harming future soil fertility. In this project I study fertilisation patterns used by Indian farmers using plot level input and output information from around 300,000 plot across the country. I estimate a semi-parametric relationship between the ratio of nitrogen used and crop output. In a quadratic specification, I use cost shifters from the fertiliser industry as instrumental variables to correct for potential endogeneity of the nitrogen ratio. I use the estimated parameters to calculate the optimal nitrogen ratio for different crops, grown on different soils. I also separate irrigated from rain-fed systems. I find that a large share of Indian cultivators overuse nitrogen with regard to the other two nutrients, and that the nitrogen-only practice can rarely be justified as optimal. This can potentially point to a reduction of the amount of nitrogen used, as a way to both increase productivity, profitability (at least for farmers who already use some of the other fertilisers), and reduce environmental pollution.

Keywords: Agricultural economics, agriculture, instrumental variable estimation, resource economics, semi-parametric estimation

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