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Global Economics of Nutrient Cycling

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Abstract: This paper briefly discusses global human requirements of protein nitrogen (N) from crops and animals, and then estimates the need for fertilizer N as a function of N use efficiency, and the recycling of N from animal manure and sewage wastes. These estimates are based on various assumptions and simple calculations. Results suggest that globally only 1% of N input is retained, 28% is lost to the wider environment, and some 70% is potentially available for recycling via manure and sewage. In addition, large amounts of nutrients recycle via crop residues. In practice, only a fraction of this potential is realized, in part because of the segregation of crop production systems from animal production (land-less livestock) systems and of the lack of economic incentives for recycling. As a consequence, nutrient use efficiency is low and nutrients are lost to the environment and create a cascade of unwanted side-effects. To economize on nutrients, side-effects of their use have to be internalized in decision making. This may be done via deposits and/or taxes to emphasize the non-disposal nature of nutrients. Increasingly, government policies provide incentives for recycling nutrients, but there are clear limits to the implementation of environmental regulations. Instead, we foresee a role for the fertilizer industry in processing and recycling animal manure from land-less livestock systems.

Key Words: Crop production, economics, land requirement, livestock, manure, nutrient cycling