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WITH INTERNATIONAL COMPARISONS

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Abstract

ECONOMIC ANALYSIS OF SOIL AND MOISTURE CONSERVATION AND MANAGEMENT ON MARGINAL CROPLANDS

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This study is about economic analysis of soil and moisture management in semi-arid dryland farming areas. In the first phase, the analysis is developed for the Sahelian zone of West Africa, but the approach used and models developed are applicable wherever limited and undependable precipitation, erodibility of soil, and depletion of soil fertility combine to make agriculture 'marginal'. The objectives of the study are to determine farming systems, practices, and policies that will increase productivity and enhance the stability and sustainability of agriculture under these marginal conditions.

A review of the literature and field conditions reveals that the economic viability of agriculture under these marginal conditions depends on choosing strategies for making the most of scarce and erratic moisture supplies, for reducing the risk of disastrous outcomes, and for making optimal choices between conserving and consuming depletable soil and groundwater resources. Thus, farm economic analysis in marginal areas must give careful attention to evaluation of risk and to optimal paths of resource use over fairly long time periods. In contrast, the farm economic issues in fertile agricultural heartlands focus more on questions of optimal level of fertilizer and other input application, profit maximizing enterprise combinations, economies of scale, and optimal investment in irrigation or other capital goods.

The analysis has four major components. First, crop yields are estimated for a wide variety of soil moisture conditions. Rainfall patterns, moisture infiltration rates, soil moisture holding capacities, and crop evaporation/transpiration rates determine the occurrence of moisture stress. The severity and duration of moisture stress determine the impact on crop yield. Soil erosion and depletion of soil fertility are also estimated as a function of cropping pattern, tillage methods, and soil conservation measures such as contour ploughing or cross-slope ridges. Long-run decline in crop productivity is estimated as a function of soil loss.

Second, a linear programming model is used to determine the combination of crop and livestock enterprises, tillage practices, and market transactions that will satisfy the household's basic food requirements and maximize profit (revenue from crop and livestock sales minus expenditure for labour and other inputs). Optimal farm plans are calculated for an array of assumptions about expected weather conditions, resource availabilities, and agricultural policies.

Third, the moisture stress-yield relationships are used to predict crop production that would be realized when farms following the 'optimal' plans experience various actual rainfall and growing conditions. The statistical properties of the resulting array of potential food supply/net income outcomes are evaluated to determine the possible trade-off between expected (planned) long-run level of average income and realized variability of income.

Fourth, alternative soil conservation and agricultural development policies and projects are evaluated for their likely effectiveness and efficiency in inducing farmers to adopt farming systems and practices that enhance and conserve agricultural productivity.