Cambodia's Agricultural Land Resources: Status and Challenges[1]

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Agricultural production in Cambodia is concentrated in the northwestern districts bordering Thailand, on the central plains surrounding the Tonle Sap Lake and its river systems, along the Mekong and Bassac rivers towards the Mekong delta, and in the northern and northeastern provinces. In 2012, the total land-use area under major agricultural crops was about 4.015 million ha. Rice is the dominant crop, occupying about 2.968 million ha; non-rice crops are grown on about 1.047 million ha (MAFF 2012). Agricultural lands can be categorised into two distinct topographical regions: lowlands and uplands. Lowland soils mainly support rice farming interspersed with field crops, vegetable gardens, and fruit trees. Upland areas are mainly used for rubber plantations, maize, cassava, soybeans, mungbeans, peanuts, sesame, sugarcane, and fruit trees (MAFF 2012).

Since knowledge about the biophysical constraints of upland soils remains limited and because Cambodian agriculture is heavily dependent on productivity of rainfed, lowland, rice-based farming systems, this policy brief focuses on crop and land management in the lowland.

SOIL PROPERTIES

Land capability for rice production in the lowlands has been thoroughly documented, but little is known about the properties of upland soils for growing non-rice crops. Land capability for field crops in Cambodia is graded into five classes (from very low to very high) based on assessment of soil acidity, nutrient availability, soil surface condition, susceptibility of nutrient and structure decline in topsoil, rooting depth, water logging, inundation, soil water storage, soil workability, water erosion risk, and phosphate export (Bell *et al.* 2006).

Rice soils are categorised into three levels of agricultural productivity potential (low, medium and high) based on the main limiting factors for growing rice (White *et al.* 1997). Low-potential soils are strongly to moderately acidic, very low in organic carbon (C) and total nitrogen (N), very low to moderate in extractable phosphorous (P), very low to low in exchangeable potassium (K), and very low in effective cation exchange capacity (ECEC); these limitations are difficult to overcome through land management. The problems of medium-potential soils – strongly acidic, very low in organic C and extractable P, and low in total N, exchangeable K and ECEC – can be corrected through land management. High-potential soils are moderately acidic to slightly alkaline, very low in organic C content, low to very low in total N content, moderate to low in P, low in K, and moderate to low in ECEC; these soils have few limitations on rice yields (Bell and Seng 2004; White *et al.* 1997). Table1 shows that more than 60 percent of the soils covered by Cambodia's soil database are very low in total N, about 88 percent are low in extractable P, and about 86 percent are low in organic C (CARDI 2009).

SOIL PRODUCTIVITY

In general, rainfed lowland rice varieties respond positively to fertiliser application. However, proper nutrition is essential for satisfactory crop growth and production, and matching soil nutrient availability to crop nutrient demand is essential for optimum yields. A field trial to examine rice yields under three different soil fertility management regimes shows

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Table1: Classification of N, P and Organic C of soil samples included in the Cambodian Soils Profile Database.

Soil properties	Classification				
	VL	L	M	H	VH
Total N (%)	<0.05	0.05-.15	0.15-0.25	0.25-.50	>0.50
% of soils in class	*63*	*34*	*3*		
Extractable P (mg/kg)		0-7	7-15	>15	
% of soils in class		*88*	*5*	*7*	
Organic C (%)	<0.06	0.06-1.00	1.00-1.80	1.80-3.00	>3.00
% of soils in class	*1*	*86*	*11*	*2*	

Note: VL –very low, L – low, M – medium, H – high, VH – very high. Source: CARDI (2009).

that responses vary with the type of fertiliser applied (Seng *et al.* 2010). Figure 1A shows the cumulative response curves of Sen Pidao, an early-maturing (110 days) rice variety, to applications of organic (composted cow manure), inorganic nitrogen (N), phosphorous (P), potassium (K), and combined organic and inorganic fertilisers for six successive crops (three wet and three dry seasons). The results indicate that compared with organic fertiliser, inorganic fertiliser application produces 30-50 percent higher crop yields, and combined organic and inorganic fertiliser application increases yields even further by 50-70 percent. By contrast, Figure 1B illustrates significant declines in crop yield – as high as 70 percent for the sixth successive crop – caused by missed fertiliser applications. These figures suggest that seasonal application of combined inorganic and organic sources of nutrients for rice crop is a key factor towards stabilising rice yields, and achieving sustainable rice production (Seng *et al.* 2010).

CHALLENGES FACING AGRICULTURAL CROPLANDS

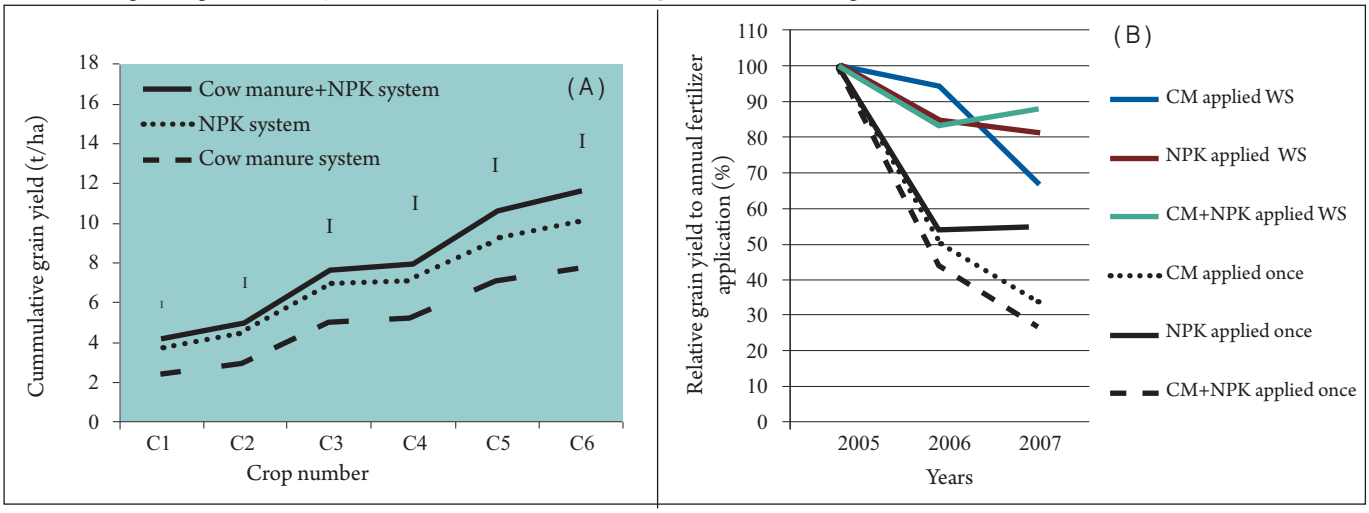
Research has focused on developing and deploying farming technologies to increase crop production; little attention has been paid to effective governance and supporting services, land-use planning and land management. The main constraints in further improving crop production are the lack of up-to-date knowledge about land resources, limited access to improved technologies and reliable information on market services, and the lack of policy instruments to govern land-use and land management. Overall, agricultural land is poorly protected, basic conservation practices are missing, and highly degradable land is managed improperly; land degradation in particular poses a significant threat to sustained agricultural productivity and food security. Population growth, together with increasing migration of land users has increased tension in respect of access to farming land and land ownership. Significant changes in land-use, especially on fragile, erosion-prone soils in upland areas, along with watersheds, are other issues of concern. Uncoordinated development decisions and lack of policy for land-use and land management could result in the unnecessary rapid conversion of productive croplands, leading to a sharp decline in agricultural production potential and leaving the country at risk of food insecurity. Current data are limited, but the conversion of arable land to urban and other non-agricultural uses is reportedly rising at an alarming rate.

POLICY RECOMMENDATIONS

The conversion of lands used for food crop production to other uses, the ongoing expansion of the cultivated area, and the situation of unused or under-used cropland has to be closely regulated to achieve sustainable increases in productivity and to provide sufficient quantities of quality foods. This situation highlights the urgent need to develop capacity to enhance land management, improve soil and crop nutrient management, and reduce environmental risks associated with agricultural intensification.

Better land management can foster sustainable soil and crop management techniques, stabilise rainfed croplands, and ultimately improve land carrying capacity. This suggests a need for a comprehensive

Figure 1: Crop responses to organic and/or inorganic fertiliser applications (A); and the effect of missed fertiliser applications (B) onrice grain yields (as relative values to annual application). In Figure B: Solid lines indicate that fertilizer was applied in wet season (WS) of each year, and the dash lines indicate that fertilizer was applied in one time (at the beginning) for three years. For more details of the experiment, see Seng *et al.* (2010).



Source: CARDI

assessment of land capability, and for systems to be in place to support environmental management. In addition, the impact of land-use change on crop production, livelihoods and the environment should be assessed, a long with trends in levels of water scarcity and land degradation. Standards and guidelines for assessment and management of the country's land resources should be established to facilitate sustainable utilisation of the agricultural land.

The problem of unused and under-used agricultural lands being held for speculative purposes requires serious attention. Strict measures that encourage the productive use of idle land, especially in areas with developed irrigation infrastructure, should target large-scale landholders.

Specific policy actions for improved agricultural land management and sustainable crop production could include:

- promulgating agricultural land law and land-use regulations
- creating a national Agricultural Land Research and Development authority
- developing standard principles and guidelines for national land resources assessment
- formulating policy to enhance the productive use of agricultural lands by targeting large-scale landholders and areas with improved irrigation infrastructure and services
- consolidating capacity in crop and soil sciences
- strengthening research capacity and scope in land-use, land policy, agricultural land management, land resource assessment, land management and conservation, and information management, and
- conducting a national land-use census as necessary to provide comprehensive and up-to-date information on agricultural land-use, land-use change, land management, and productivity trends.

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The DRF vision is of a high capacity, professional and vibrant Cambodian development research community. Its goal is to support and strengthen the capacity of the Cambodian development research community.

The DRF partnership involves the Cambodia Development Resource Institute (CDRI), Cambodian Economic Association (CEA), Learning Institute (LI), National Institute of Public Health (NIPH), Royal University of Agriculture (RUA), Royal University of Phnom Penh (RUPP), Supreme National Economic Council (SNEC) and the International Development Research Institute (IDRC).

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