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Biofuels and resource use efficiency in developing Asia: Back to basics

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ABSTRACT

In Asia, as elsewhere in the world, countries rushed to promote biofuels during the dramatic oil price increases of 2007–2008 as a way to enhance energy security, without waiting for the settlement of controversial debates about the environmental effects of biofuels, especially their effects on greenhouse gas emissions, deforestation, biodiversity, and whether biofuels cause a conflict between food and fuel. This paper does not settle this debate, but instead argues that there are straightforward, practical and feasible measures that can be implemented immediately in order to reduce the pressure of biofuels on the environment and food supply, and more generally increase food production. The key is to focus on increasing resource use efficiency in agriculture, especially on different forms of energy use. Resource use efficiency in agriculture is low in many parts of Asia. Concrete measures that could be taken include reductions in market-distorting input subsidies and the introduction of resource-conserving technologies. These could be supplemented with greater use of non-fossil fuels in agricultural production, use of agricultural wastes in energy production, inclusion of input use levels in biofuel certification systems, and greater investment in agricultural research, extension systems, and infrastructure development. Biofuel fever has waned since the onset of the global financial crisis in late 2008, but it is likely to return when economic conditions eventually improve, and possible moves to strengthen the European Union biofuel blending requirements could further accelerate it. Much of the debate on biofuel-related impacts in the region has focused on deforestation, with little attention on agricultural input use, which could also have serious consequences for greenhouse gas (GHG) emissions. In sum, this paper argues that governments can still improve the environmental performance of biofuels while reducing potential conflicts with food security by implementing the straightforward measures suggested here. Though these may appear to be basic textbook suggestions, many governments are still not following them even though the spread of biofuels increases their importance and urgency. The message is that the governments in the region should get back to the basics.

1. Introduction

In Asia, as elsewhere in the world, countries rushed to promote biofuels during the dramatic oil price increases of 2007–2008 as a way to enhance energy security, without waiting for the settlement of controversial debates about the environmental effects of biofuels, especially their effects on greenhouse gas emissions, deforestation, and biodiversity, and whether biofuels cause a conflict between food and fuel. The available statistics suggest that the Asia-Pacific region accounts for nearly 25% of world bioethanol production [1]. (the) People's Republic of China is currently the largest producer of bioethanol in the region followed by India. About 1.06% of total transport fuel in the Asian region came from biofuels in 2004 [2]. Many countries in the Asian region also have targets to further enhance the production of biofuels. For example, India currently has targets to blend 5% of bioethanol in transport fuel in designated states [3] even though the national government withdrew its overambitious target to blend 20% biodiesel and bioethanol by 2017, while (the) PRC has targets to produce 10 million tons of bioethanol and 2 million tons of biodiesel by 2020 [4].

Many crops grown for food purposes (e.g., oil palm, corn, cassava, sugarcane, etc.) were quickly converted to first generation biofuel feedstock. It is expected that the Asian region will continue to promote first generation biofuels before the second generation biofuels are fully commercialized. Even though countries like (the) PRC and India adopted policies to discourage the use of food or feed crops for biofuels, concerns persisted that these policies might be difficult to implement, and that biofuels would still directly or indirectly compete with food and feed.

This paper does not settle this debate, but instead argues that there are straightforward, practical, and feasible measures that can be implemented immediately in order to reduce the pressure of biofuels on the environment and food supply, while at the same time increasing food production. The key is to focus on increasing

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resource use efficiency and productivity in agriculture, especially for energy, which is low in many parts of Asia.

Biofuel fever has waned since the onset of the global financial crisis in 2008, but it is likely to return when economic conditions eventually improve, and possible moves to strengthen the European Union's biofuel blending requirements could further accelerate it. Moreover, many Asian countries still face increasing population pressures and corresponding increases in food demand [5], so the urgency of addressing the issue of resource use efficiency will continue to increase.

The question of resource use efficiency has been the subject of extensive debate in the agriculture literature and in policy making globally as well as in the Asian region [6]. While resource use efficiency may be a routine, text-book issue, this paper argues that it becomes increasingly urgent when limited agricultural resources such as land, water, and fertilizers are increasingly being used for other competing purposes such as biofuels. The 2008 global food price crisis may have been caused or worsened by diversion of crops to biofuel production, though other factors such as increasing population, changing consumption trends, and weather abnormalities may have also contributed. During this crisis, many countries in Asia took strong steps such as restricting food exports to allay fears of food insecurity, including in some cases measures to restrict biofuel production from food- or feed-based crops. However, it is not clear how effective these measures were, and countries also did not address other factors contributing to the crisis very well [7–9].

Much of the debate on biofuel-related impacts in the region has focused on deforestation, with little attention on agricultural input use which could also have serious consequences in terms of greenhouse gas (GHG) emissions and other environmental impacts [10]. These impacts mostly result from fertilizers, pesticides, and on-farm fossil energy use [10,11]. For example, feedstock production constitutes 26.2% of total lifecycle GHG emissions in cassava-based ethanol production, with fertilizers accounting for 35.6% of feedstock production emissions [12]. Crutzen et al. [13] also point out that the GHG reduction potential of biofuels (from replacing fossil fuels) could be offset by N_2O emissions from agro-biofuel production. The ongoing debate on impacts of biofuels also misses the point that the improper use of fertilizers in some parts of the Asian region has led to declining factor productivity [14], which adversely affects both food production potential as well as the GHG implications of biofuels produced from agricultural crops.

In this paper, we argue that increasing agricultural resource use efficiency, especially focusing on efficiency of input use, is very important in order for the countries in the region to avoid a recurrence of the food crisis experienced in early 2008, and it simultaneously address the problem of climate change – regardless of whether biofuels continue to be promoted. Increasing resource use efficiency in agricultural production of first generation feedstocks has multiple advantages such as limiting land use changes from forests, since more food could be produced from even less land, and reducing GHG emissions by curtailing excessive use of fertilizer and other fossil fuels. Much of the literature cited and data used in this paper covers various Asian developing countries such as (the) PRC, India, Indonesia, Thailand, and Viet Nam, and comparisons are made, wherever applicable, with developed Asian countries such as Japan or countries outside the region such as Brazil or the US.

2. Need for increasing resource use efficiency

While many resources are used in agricultural production in general, as well as in first generation biofuel feedstocks, this paper largely focuses on mutually inter-linked factors of production such as land, primary energy use in the form of direct on-farm energy, and secondary energy use in the form of fertilizers.

2.1. Agricultural land productivity

The current levels of agricultural land productivity are relatively low in many developing countries in Asia [6] which have also experienced significant efforts to promote biofuels. Increasing the productivity of land has multiple advantages – the most important one is that a substantial amount of land can be freed for a variety of alternative uses. An increase in rice productivity from the current level of 3.8 tons per hectare (the average productivity in India, Indonesia, Thailand, Viet Nam, and Malaysia, which are major rice-growing countries and promoters of first generation biofuels) to 6.3 tons per hectare (the current level recorded in (the) PRC) would make available 23 million hectares of land for other purposes, possibly including biofuels. Even more potential exists if the productivity of other staple food crops, oil seeds, and pulses could be increased in the region (Fig. 1). Such productivity increases could also save similar amounts of land from deforestation and other ecologically destructive economic uses.

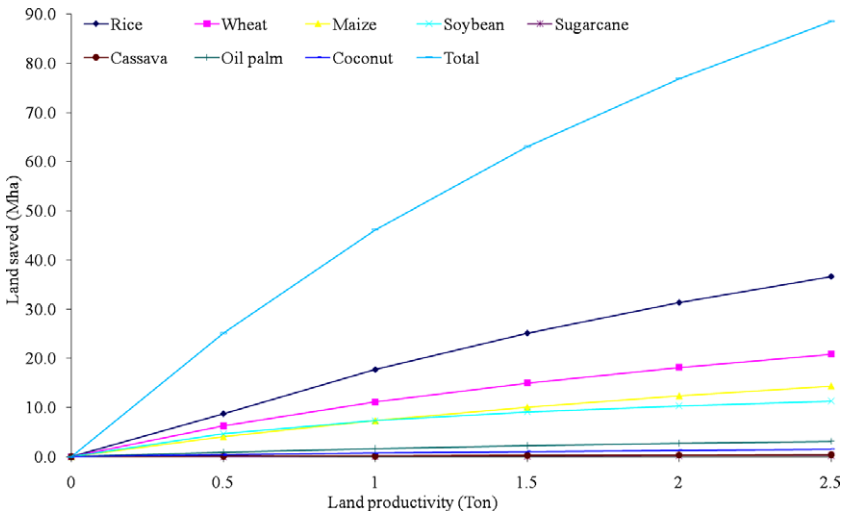

Fig. 1. Potential land saved due to the impact of increased land productivity for different crops grown in Asia. (Data source: FAOSTAT [17], *Note*: Current level of crop productivity is represented by 0 on the *x*-axis.)