Journal of Environmental Management 128 (2013) 15–21

Contents lists available at SciVerse ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Determinants of rice residue burning in the field

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ARTICLE INFO

Article history:
Received 27 August 2012
Received in revised form
2 February 2013
Accepted 20 April 2013
Available online

Keywords:
Rice residue
Field burning
Removal
Incorporation
Southwest region of Bangladesh

ABSTRACT

This study determines the factors that influence rice residue burning in the field. We consider the southwest region of Bangladesh as the study site. Our results indicate that while straw length, low-elevation land, and distance of the plot from homestead positively and significantly influence the rice residue burning decision, residue price negatively and significantly influences the residue burning decision of farmers. Our study proposes subsidies for the purchase of new varieties of seeds and/or education in order to persuade farmers to move to short-straw varieties on high/medium-elevation lands as policy interventions for handling the residue burning issue. Another option might be to switch from residue burning to incorporation. Research and development efforts into shortening straw length and shortening the time period between planting and harvesting time are among other options that would mitigate the problem under consideration.

1. Introduction

Open burning of crop residue in the field generates gaseous and particulate emissions (Badarinath et al., 2006; Zhang et al., 2008). Such residue burning in the field adversely affects both the health of the population and the climate (Auffhammer et al., 2006; Long et al., 1998). However, if residue burning takes place either at home for cooking and other household purposes or for industrial usage, it may contribute to production and consumption activities even though it has an adverse health and climate effect.

The open burning of crop residue in the field is a common practice in many countries (Gadde et al., 2009). It is a human initiated activity for the purpose of preparing the fields for the next crop rapidly and inexpensively (Gadde et al., 2009; NDEP, 2003; Webb et al., 2009). By burning residue in the field, farmers derive specific benefits such as cost- and time-savings (Lal, 2008). It is also a means to control weeds, diseases, and pests (Gadde et al., 2009; Lal, 2008; NDEP, 2003).

On the other hand, field burning of crop residue converts a great deal of nutrients to gaseous form, which is then lost from the site. Ghimire (2007), for example, has shown how some of the carbons contained in the crop residue is lost if it is burnt in the field. Moreover, the burning of residue gives rise to emissions of Heavy Metals (HM) and dioxin (Webb et al., 2009). While a study by Brady and Weil (2002) has shown that crop residue burning in the field emits large quantities of CO, CO_2, particulate matter and volatile hydrocarbons into the air, EIA (2008) has found that it emits methane and nitrous oxide. These emissions indubitably contribute to climate change.

Since crop residue burning causes nutrient and resource losses while adversely affecting soil properties, there have been calls for improvements in harvesting technologies and residue management systems (Gupta et al., 2004). Brye et al. (2006) and Yadvinder-Singh et al. (2004), for instance, have argued that field burning of crop residue is not only environmentally-unfriendly and undesirable but also may not be sustainable. Lal (2008) sees field burning of residue to have far-reaching negative impacts, such as air quality degradation and loss of organic materials.

To date, there are few studies tracing the determinants of crop residue burning in the field. This is arguably the first study that uses farm-level data to address the residue burning issue in the case of Bangladesh. Since there is neither a database on the amount of crop residue produced in the country nor a specific guideline or policy for the proper management of the residue produced, the findings of the research might fill a significant lacuna in knowledge in this particular field.

Rice is the most important crop of Bangladesh from the perspectives of production volume, value, cultivated land coverage and

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0301-4797/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jenvman.2013.04.046

employment generation (BBS, 2011). In 2009–2010, Bangladesh produced 31.98 million metric tons (mt) of rice on 11.36 million hectares of land (BBS, 2011). The residue derived from this volume of production, although big, has not yet been measured in any study.

Rice is harvested and rice residue is managed manually in Bangladesh. The available practices for rice residue management in the country are: (a) burning in the field, (b) incorporating in the field, and (c) removing from the field, either for burning along with cow-dung or for feeding cattle herds. Discussions with experts and farmers as well as field visits also confirm the existence of all these three approaches for managing rice residue in Bangladesh. This study focuses on the issue of residue burning in the field while treating the other two approaches (incorporation and removal) as the alternatives. It attempts to develop an understanding on the behavior of the farmers with respect to these practices. For this purpose, using primary data collected from the southwest region of Bangladesh, it tries to answer the following research questions:

1. What are the main reasons behind the rice residue burning practice in the field?
2. What policy measures may be taken for the efficient management of rice residue?

2. Study area and survey

The study takes the southwest region of Bangladesh as the study site. For the purposes of this study, the Kushtia, Meherpur, Magura, Chuadanga, Jhenaidaha, Jessore, Satkhira, Khulna, Bagerhat, Narail, Faridpur and Rajbari districts comprise the southwest region of Bangladesh (see Fig. 1). Double cropping patterns dominate the region due to its geographical and other characteristics, such as low land elevation, proximity to sea and higher salinity level. The study focuses on rice farmers, *Aman* and *IRRI* being the two main rice varieties cultivated in this region. Since the quality and management practices of rice residue derived from *Aman* and *IRRI* varieties vary significantly, this study considers these two while addressing the objectives.

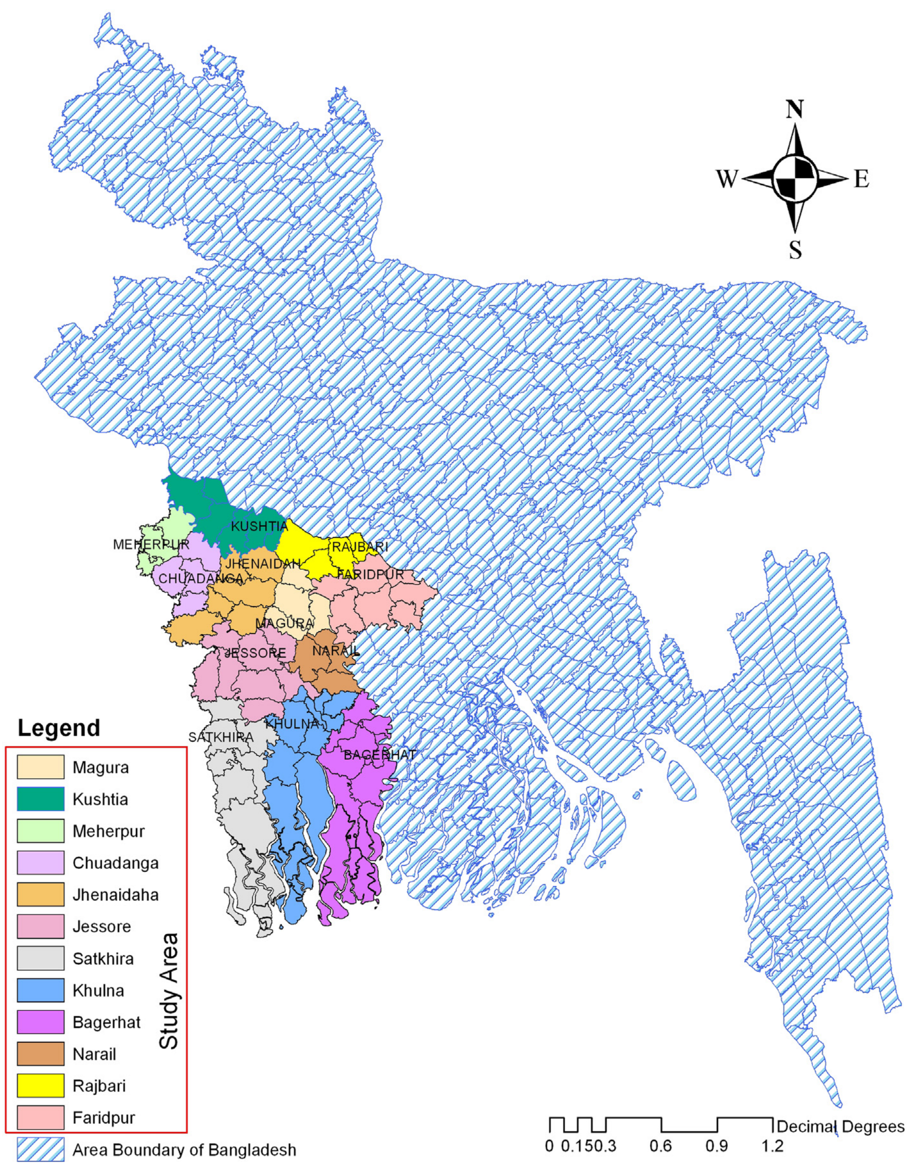

Fig. 1. Study area map.