

Le Corps professoral de  
Gembloux Agro-Bio Tech - Université de Liège vous prie  
de lui faire l'honneur d'assister à la défense publique de la dissertation originale que

**Madame YANG Xiaomei,**

**Titulaire d'un diplôme de *master of natural science (ecology)*,**

présentera en vue de l'obtention du grade et du diplôme de

**DOCTEUR EN SCIENCES AGRONOMIQUES ET INGENIERIE BIOLOGIQUE,**  
le 14 décembre 2018, à 15h30 précises (personne ne sera admis après cette heure),  
en l'auditorium ER1 (Bât. 18),  
Passage des Déportés, 2, à 5030 GEMBLoux.

Cette dissertation originale a pour titre :

« How to support environmental protection policy in agriculture: a case study in Henan and Hebei provinces, China ».

**Le jury est composé comme suit :**

Président : Prof. J. BOGAERT, Professeur ordinaire,

Membres : Prof. P. LEBAILLY (Promoteur), Prof. C. YIN (Copromoteur - CAAS, Chine), Prof. B. BODSON, Prof. P. BURNY, Prof. F. FRANCIS, Dr HO T. M. H. (ISA, Vietnam).

## Summary

Crop straw (agricultural residue) is one of the most important biomass resources in China. Crop straw is either burned in the field or collected for recycling. Open burning of crop straw releases particulate matter and gaseous pollutants, which play a key role in poor air quality, prompting heavy haze episodes during the harvest season. Such episodes threaten human health and interfere with social and economic activities. In contrast, recycling of crop straw reduces open burning and avoids its negative environmental impacts. In fact, improving the efficiency of straw use contributes to a circular economy, dedicated to reducing waste, while also making the best use of any 'waste' in economically viable processes that increase its value. Returning straw to agricultural fields in China is the easiest solution and the most important measure promoted by governments promising clean technologies to replace open burning. Recently, China's municipalities have issued regulations forbidding outdoor burning of straw to reduce air pollution and have passed regulations to encourage farmers to use straw shredders during harvesting, and return crop straw as a bio-fertilizer. However, these regulations have not achieved the desired results, with ongoing open burning and reluctant use of straw on fields.

In the first part of this research, urban residents' willingness of to pay (WTP) for a corn straw ban in Henan (China) was assessed using contingent valuation in a face-to-face survey. Such assessments are important for policy makers to determine the investment and policy instruments for regulating the environmental impacts of straw open burning. The expected WTP analyzed using the Tobit model was about 77 RMB per person per year for the total respondents and 143 RMB per person per year for respondents with positive WTP bids. Aggregate values were between 3.4 and 3.9 billion RMB, suggesting that the corn straw burning ban is of considerable economic value in Henan.

In the second part of this research, the factors affecting farmers' willingness to participate in corn straw return and their willingness to accept compensation (WTA) were explored using a questionnaire survey and face-to-face interviews. A logistic regression model was used to assess adoption success, and the Tobit model was used for WTA analysis. High machinery costs, amount of straw returned, and slow decomposition rates of straw were the most significant factors negatively influencing adoption of this practice. They had a positive influence on the WTA. Poor quality of the straw was another significant factor reducing the probability of using straw return technology. Sown areas and soil improvements associated with adding straw were both positive factors determining adoption of the practice and negative determinants affecting WTA compensation. The mean WTA for the total respondent sample was 47 RMB per mu.

In the third part of this research, a field experiment was carried out to compare the effects of tillage (minimum/full tillage) combined with corn straw return (mulching, incorporation, and removal) and irrigation (reduced/normal irrigation) methods on wheat productivity and water conservation. In 2013-2014, the yield for minimum tillage with residue mulch ( $MT_m$ ) was slightly but not significantly higher than the yield under full tillage with residue incorporation ( $FT_i$ ). Yields for  $MT_m$  with reduced irrigation were 10.2% higher than  $FT_i$  and reduced irrigation. The positive crop response to  $MT_m$  may reflect higher topsoil moisture and soil temperature under  $MT_m$  compared with  $FT_i$  during winter.

In conclusion, this study showed there is huge value to prohibiting open burning of corn straw to improve air quality. Despite machinery and operational problems that negatively influence farmers' enthusiasm for straw return, minimum tillage coupled with corn straw return does benefit subsequent wheat yields.