Corn stover as a feedstock for renewable energies – RES
Possible cooperation in problem solving

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Corn is major field crop in all Danube downstream countries. Its residue, namely corn stover, is the most important and until now not used feedstock for RES. Utilization of corn stover as renewable resource is very positive regarding GHG savings, defined by few EU documents, and especially RES Directives. Several studies about potentials, conversion possibilities, procurement, costs and environmental impact of corn stover use as an energy source have been conducted.
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**Emissions in cultivation phase**

<table>
<thead>
<tr>
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<th>gCO₂eq/MJ</th>
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<tbody>
<tr>
<td>Corn stover</td>
<td>2</td>
</tr>
<tr>
<td>Corn stover with macronutrients</td>
<td>4</td>
</tr>
<tr>
<td>Corn silage</td>
<td>18</td>
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GHG emissions comparison of biogas substrates
(own investigations and Giuntoli et al., 2014)
Most significant are: as a feedstock for production of lignocellulosic bioethanol –LCB, 2G biofuel, as a co-substrate for biogas generation and also as a fuel for combustion. The following problems were identified:

1. Proper collection and storage procedures for corn stover are not solved in Europe yet.
2. For LCB production are needed big amounts of feedstock, and would be better to organize supply from more than one country.
3. The pre-treatment of corn stover for biogas production is needed.
EXAMPLE 1 Lignocellulosic Bioethanol LCB

Done in a frame of S2BIOM project.

Study on applicability of crop residues, first of all corn stover, for production of lignocellulosic bioethanol.

PLANT FOR LIGNOCELLULOSIC BIOETHANOL PRODUCTION IN SERBIA

Case Study

–Final Report–

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First European LCB plant PROESA Crescentino, Italy

Novi Sad, Serbia, 2015
Harvest procedures, based on experiences in other countries and abroad were considered. It was found out that the best solution will be to perform two-pass procedure, but machinery for it is at this moment unavailable in Europe. The storage was tackled as well, and it seems that it presents not so big problem as it was assumed. The open air storage on elevated basement and by tarpaulin covered stacks seems to be reasonable solution. Costs of harvested, finished by storing at primary storage till delivery for corn stover dry matter were estimated to be between 42 and 45 €/t, including values of removed nutrients and some revenue for farmers.
Supply logistic was evaluated by application of location-allocation-problem, and best locations for LCB refinery identified, whereby only locations having Danube harbour were selected. These resulted with estimation of average supply costs for corn stover on a plant Location of 57 and 60 €/t for water and road transport, respectively.
EXAMPLE 2  Co-substrate for biogas production

www.biogas-systems.com/

Pre-processing of corn stover is in early commercial maturity phase
EXAMPLE 3  Combustion and co-firing

Pellets made of corn cobs seem to be good fuel for small and medium heat generators.

Co-firing with, e.g., wood chips, can be used for big units. Here is an example from Poland.
Acceptable corn stover harvest procedures should fulfilled following demands (our statements):

1. Collection of corn stover may not considerably interfere grain harvest productivity. Acceptable reduction of productivity is up to 10%.
2. Corn stover should be contaminated by soil (soiling) as little as possible. Acceptable value is up to 5%.
3. The corn stover collection may not cause high grain losses, if the harvest procedure can interfere it. Acceptable increase of losses is up to 1%.

Level of GHG emissions caused by utilization of corn stover plays significant role!

Preservation of soil fertility is also very important!
MAJOR PROBLEM – COLLECTION, HARVESTING, PROCUREMENT

Solution developed in USA, header with integrated chopper and windrower, not available in Europe

Solution of header with integrated chopper and windrower, available in Europe
Total ash content was measured
About 17% for star wheel rakes
About 9% for continuous belt merger
Course of moisture content in stored bales, covered with tarpaulin and uncovered
LAST MESSAGE

Objective: To find procedures and develop equipment for efficient procurement of corn stover.

The partners interested in it:
1. R&D institutions
2. Machinery manufacturers
3. Innovative farmers
4. Innovative individuals
5. Governmental institutions…

ARE SOUGHT!!