AGRICULTURAL VEGETAL WASTE – RESOURCE FOR RISK MITIGATION IN GLOBAL WARMING CONDITION

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Abstract

The vegetal wastes are secondary products from agricultural activities which mostly remain chaotically into the soil. As result vegetal waste disrupts technological process. Generally, the secondary products are unvalued because of lack of financial resources or means work of farmers. Many farmers have this behavior, especially they who own small agricultural areas. Cellulosic content of waste i.e. straws, corncobs represents an important source of energy which must be used. Referring to this noted that exist an energetic rich from cereals grains and from the ratio of main production and secondary ones. The issue of unused wastes is neglect for this resource. These aspects characterizes as we said smaller farms which are the numerous. The loss is magnified even more with how these products can be obtained from ethanol, butanol or other compounds that may be fuel or raw materials for chemical industry. Worldwide, specialist research has shown that the use of bioethanol instead of fossil fuel can reduce CO_2 emanations, which is the cause of global warming. In this context, it is indicated release of processes for the implementation of measures to combat climate change. In this order until 2020 European Union propose all the states members that 20% of energy used to be ensured by renewable including secondary products from agriculture. This paper emphasizes the relevance of vegetal wastes as significant resource for risk mitigation in agriculture from global warming point of view. To that evaluation of vegetal waste was studied. Also, the paper aim are to show how can be make conversion of lignocellulosic biomass to ethanol and how can be combated the greenhouse effect. In this respect procedures and statistical data was used.

Keywords: *vegetal wastes, secondary products, bioethanol, lignocellulosic biomass, climate change*

Jel Classification: Q16, Q18, Q42, Q54, Q56.

Introduction

The agriculture is an important economic and social field with significant contribution in sustainable development. Agriculture is on the one hand a provider by human food and on the other hand an important support in order to ensure biomass from alternative energy. Due of biological and technological processes which occur is necessary to take into consideration the responsabilitty of agriculture for the protection of environmental resources such as soil, water, air. The agricultural techniques are intensive agricultural production inputs, cumulative energy and thus producing waste and gas emanations (for instance CO_2, the cause of global warming).

After Pickett, reducing gas emissions varies depending on how the plant is grown, how it is processed and how it is used biofuel (quoted by Georgiana Fefe in Science, February 20th, 2008, accessed in 08/05/2015).

The increase of cultivated areas has beneficial role in CO_2 consumption by vegetation in obtain food products and biofuel (eg bioethanol).

About the energy from biomass / waste vegetal are discussions. There are the pros and cons. There are still debate internationally, the more that natural resources should be saved because decreased significantly and, in this case, must be use economically. In the same time the natural resource require close monitoring because of increase in the concentration of CO_2, with obvious repercussions as global warming.

For "pro", vegetal species cultivated represent a form of renewable and constant energy being managed scientifically according to economic requirements anywhere in the world (there may be abundant vegetal resources).

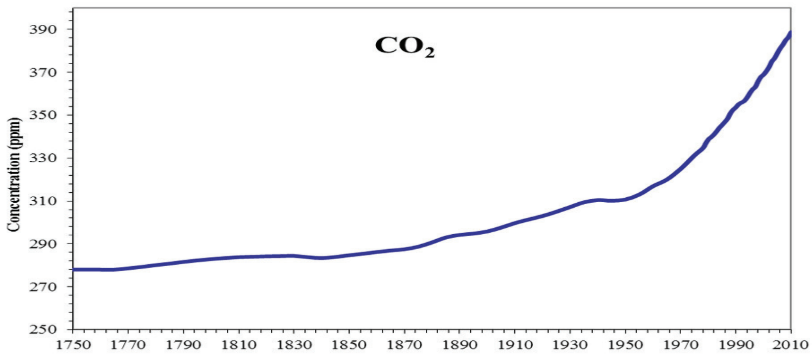
Biomass is part of the carbon cycle (the carbon is absorbed from the atmosphere during photosynthesis and when vegetal plant decomposes or vegetal waste is burned, the carbon is back into the atmosphere) and biomass fuels are "clean" because the CO_2 emanation from the burning is much smaller. In an agricultural activity, for example, it has shown that energy harnessed from biomass is cheaper compared to fossil fuels consumed. This means that, over time, biofuels determine significant savings. Moreover, raising fuel prices make that biofuel to represent an efficient alternative.

For „cons" of renewable energies are, first of all, technologic high costs in order to obtain biofuel. Also, the high cost for the harvesting and storage of biomass.

Material and method

The quantity of CO_2 which causes the greenhouse effect has grown considerably in the last century. Measurements show that have exceeded 380 million liters per liter of air (Lumina Newspaper, Science and Technology, 14 March 2008).

The situation can be seen in Figure 1 (Atmospheric greenhouse gas concentrations - CSI 013/CLIM 052 - Assessment published Jan 2013). The same source shows that the value of CO_2, in 2011, was 390.9 ppm. The monthly average global CO_2 concentration increased in 2015 to 400.83 ppm, well above its value before the industrial revolution (300 ppm); the specification being quoted by Universe Engineering, in May 2015. Therefore, in the last hundred years, CO_2 concentration has increased by approx. 100 ppm, so on average 1 ppm (parts per million) per year; however, after 1950, growth was emphasized. The objective uncontested for safe CO_2 is 350 ppm (Michael McGee, 2008).



Source: Trends in Atmospheric Carbon Dioxide provided by National oceanic and atmospheric administration (NOAA)

***Figure 1*. Worrisome increasing of CO_2 in the atmosphere**

CO_2 is used only by the vegetation. From photosynthesis it bind humanity components such as glucides, lipids, protide and maintain viable structure of air. Therefore, there is no doubt that energy from biomass/vegetal waste lignocellulosic must be used to replace the energetic potential of fossil fuels. Technological scheme for conversion of biomass into biofuel is presented in Figure 2. Cellulose can be degraded enzymatically by its monomers, carbohydrate derivatives, which can then be fermented to ethanol (alcohol absolute; C_2H_5OH).

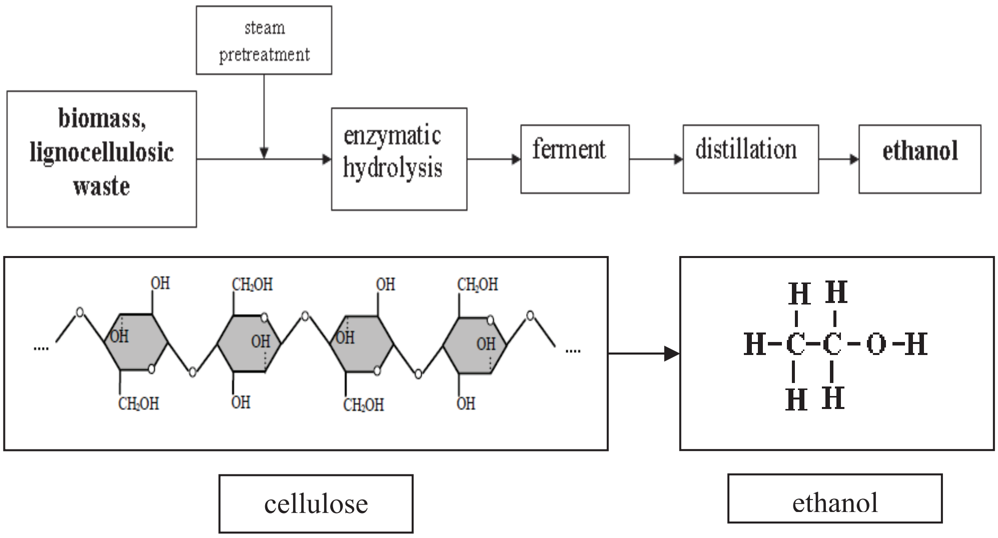
Bioethanol has multiple advantages. Between these, bioethanol can be produced inexpensive on an industrial scale, also is easily stored and distributed (oil).

Bioethanol is classified as readily biodegradable, water-miscible and when burning waste emission is carbon dioxide and water vapor.

Bioethanol has also disadvantages. These consist in the slow rhythm of mass production, so it is not widely available, on the one hand, and on the other by car engines that require changes to work with the type of fuel ethanol.

Obtaining bioethanol requires large agricultural areas or forest. Also, farmer's orientation by biomass energy means rejecting food crop and an increase of food prices, and possible food shortages.

In these circumstances, for Romania, a judicious exploitation of this viable energetic alternative is arable land, with express reference to the uncultivated land which represents 800 thousand hectares and the most of them are in north-west Region (AgroRomania.ro).



Source: Photochemical obtaining ethanol - processing literature

Figure 2. **Technology of bioethanol obtained from vegetal waste**

Projections regarding the economic waste vegetal efficiency in order to obtain bioethanol, using statistical methods, inclusively to determine the predictable area level of maize and sunflowers, as are performed. To make these is taken into consideration the Statistical Yearbook of Romania database**.** Also, in order to determine economic efficiency of maize and sunflowers the indicators was used such as average production, expenditures per hectare, incomes per hectare, cost of production and sale-price of production. Rate of profit is computed, also, which represents the most significant in efficiency evaluation.

Results and discussions

A case study is presented in this section. According to data outlined in material, note that thousand of area are uncultivated. Our proposal refers to cultivate 400 thousand hectares with maize and sunflowers. Pretability is taken into consideration for such crops. The aim is to establish optimal production structure and convert vegetal waste in bioethanol.

Introductory information:

- crops: maize and sunflower
- total area: 400 thousand hectares
- average maize production: 4000 kg/ha
- average sunflower production: 2000 kg/ha
- sale maize price: 0.9 lei/kg
- sale sunflower price: 1.5 lei/kg
- maize expenditure: 2,7 thousand lei/ha
- sunflower expenditure: 2.9 thousand lei/ha

Remarks:

1. The sale price, average production and expenditure are not changed.
2. The crops rotation refers to one year

Starting from data were created variants sharing the available area between maize and sunflower considering the rotation. They were created three different production structures. It was aimed at the share between maize and sunflower. Calculations show different results.

For the beginning were considered equal shares between crops (Table 1). The results show that the profit rate is 17.85%. For a more comprehensive analysis, were analyzed and compared Table 1 with Table 2. The results are significantly higher, the profit rate being equal with 25.45%. Therefore, the best option in economic and environmental terms is variant 2.

Table 1 **Variant 1**

Crop	**Area**		**Expenditures**			**Incomes**			**Profit**			**Rate of profit**
	ha	%	thousand lei/ha	thousand lei	%	thousand lei/ha	thousand lei	%	thousand lei/ha	thousand lei	%	%
Maize	200000	50	2.7	540	48.21429	3.6	720	54.54545	0.9	180	90	33.33333333
Sunflower	200000	50	2.9	580	51.78571	3	600	45.45455	0.1	20	10	3.448275862
Total	400000	100	Total	1120	100	Total	1320	100	Total	200	100	17.85714286

Source: Own calculation

Table 2 **Variant 2**

Crop	**Area**		**Expenditures**			**Incomes**			**Profit**			**Rate of profit**
	ha	%	thousand lei/ha	thousand lei	%	thousand lei/ha	thousand lei	%	thousand lei/ha	thousand lei	%	%
Maize	300000	75	2.7	810	72.32143	3.6	1080	81.8	0.9	270	96.5	33.33333333
Sunflower	100000	25	2.9	290	25.89286	3	300	18-Feb	0.1	10	3-Jan	3.448275862
Total	400000	100	Total	1100	98.21429	Total	1380	100	Total	280	100	25.45454545

Source: Own calculation

Because sunflower can not return on the same area 7 years, propose that 400 thousand hectares to be cultivated with maize. The results are presented in Table 3.

***Table 3* Variant 3**

Crop	Area		Expenditures			Incomes			Profit			Rate of profit
	ha	%	thousand lei/ha	thousand lei	%	thousand lei/ha	thousand lei	%	thousand lei/ha	thousand lei	%	%
Maize	400000	100	2.7	1080	100.0	3.6	1440	100.0	0.9	360	100.0	33.33333333
Total	400000	100	Total	1080	100.0	Total	1440	100.0	Total	360	100.0	33.33333333

Source: Own calculation

***Table 4* Vegetal waste**

Crop	Area, thousand hectares	Average production, kg/ha	Vegetal waste, kg/ha	Total vegetal waste, kg
Maize	300	4000	3000	900000
Sunflower	100	2000	1500	150000

Source: Own calculation

***Table 4* Vegetal waste**

Crop	Area, thousand hectares	Average production, kg/ha	Vegetal waste, kg/ha	Total vegetal waste, kg
Maize	300	4000	3000	900000
Sunflower	100	2000	1500	150000

Source: Own calculation

Table 5 **Bioethanol from vegetal waste**

Total vegetal waste, kg	Bioethanol, liters
900000	162000
150000	27000

Source: Own calculation

Note that the profit rate is high, even in the monoculture. However, for effective use of the productive potential of land, it can create a rotation that allows the practice of other crops that are in direct compatibility with maize and for which there is demand. But, this is another problem. The aim of this discussion is transforming vegetal waste from maize and sunflower in bioethanol. Based on initial data, namely at the level of average production per hectare, was determined amount of vegetal waste in every crops. The ratio between the amount of vegetal waste and overall production is 3:4 to maize and sunflowers, so 3.000 kg /ha vegetal waste from maize and 1500 kg from sunflower. In these conditions taken into consideration areas of crop, means 900000 kg vegetal waste from maize and 150000 kg from sunflower (Table 4). The result shows 162,000 liters of bioethanol from maize and 27,000 liters of bioethanol from sunflower or 1 kg of waste turn into 0.18 liters of bioethanol (Table 5).

Conclusions

It has been found that bioethanol can replace fuel with significant energy savings, with impact on reducing gas emanations. Also, the potential for biomass or vegetal waste should continue to be exploited as a source of energy because of its components which include cellulose, hemicellulose, lignin, protein, simple sugars, water, and other compounds. In these conditions it is necessary to accelerate the development of sustainable technologies on obtaining biomass. For that it is necessary to structure the vegetal species on areas of suitability, in terms of economic and ecological performance. In order to determine economic efficiency of maize and sunflowers the rate of profit was used which represents the most significant in efficiency evaluation. The study shown several variants of production structure based on maize and sunflower, which can determines significant quantities of waste in order to turn them into bioethanol. For this, started from recent studies on land in Romania and statistical attempts were made to use the land for maize and sunflower. The three variants of the production structure showed that there is scope combine crop, which determine high economic results. Also, the calculations showed that 75% of the total production is vegetal waste, which may be obtained by processing bioethanol in amount of 18 liters per 100 kg of vegetal waste.

Acknowledgement

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