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THE ROLE OF AGRICULTURAL BIOMASS IN THE FUTURE BIOECONOMY

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ABSTRACT

The European Commission presented the 2018 Bioeconomy strategy, which developed an action plan for a resource-efficient, competitive and sustainable economy. The bioeconomy sectors are also linked to the European Green Deal, Stepping up Europe's 2030 climate ambition Communication, Farm to Folk Strategy and other innovation strategies. In the transition to a low carbon world, biomass plays a crucial role as an alternative to fossil resources. In the EU, agriculture is the main source of biomass with 68% of the total supply. The paper analyses European Union agricultural biomass potential, supply and use. Agricultural biomass is part of the core bioeconomy sectors and its demand is increasing. However, the potential of biomass and its alternative uses are a major concern. Biomass is a renewable but limited resource and, on that basis, it is important to outline the balance and to pay attention to the relationship between the nutritional and industrial needs of biomass in terms of food and energy security. The policy framework in this regard has to be complex and well-targeted. The biomass use could lead to a number of benefits associated with resolving global issues. On the other hand, if sustainability is not taken into account, the opportunities for inclusive growth and development will not be achieved.

Key words: sustainability, low carbon economy, food security

INTRODUCTION

The concept of bioeconomy is in the centre of various discussion among different stakeholders. In the past decades, bioeconomy elements and dimensions have been transformed. It has shifted from the resource substitution perspective to the biotechnology innovation perspective (1).

The European Commission presented the 2018 Bioeconomy strategy which developed an action plan for a resource-efficient, competitive and sustainable economy. Bioeconomy sectors are also linked to the European Green Deal, Stepping up Europe's 2030 Climate Ambition Communication, Farm to Folk Strategy and other innovation strategies (2, 3). In the transition to a low carbon world, biomass plays a crucial role as an alternative to fossil resources. In the EU, agriculture is main biomass source with 68% of the total supply.

In this context, the aim of the paper is based on the analyses of European Union and Bulgarian agricultural biomass potential and supply to highlight conclusion and recommendation for sustainable and balanced use of this renewable but limited resource.

The article is structured as follows: 1) First, the material and methods of the survey are outlined; 2) Second part focuses on agricultural biomass supply, use and sources; 3) Third section presents the main challenges and opportunities for biomass application. In the last part, some conclusion and recommendation are drawn.

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METHODS

There is no internationally accepted definition of a bioeconomy. The concept of bioeconomy is changing and evolving in parallel with global challenges and emerging environmental issues. Different authors and organizations (4-6) have analysed the sectors of bioeconomy and their contribution to green growth. On the other hand, these studies are not comparable due the fact that the sectors vary considerably.

According to the new 2018 European Bioeconomy Strategy: "It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services (biomedicines and health biotechnology are excluded)" (7).

Based on the EU definition, European Commission classified the bioeconomy sectors as: core bioeconomy, partial and indirect sectors (8). This paper is based on the definition and classification of the European Commission.

The methodological framework is based on the Joint Research Centre approach for calculation and estimation of agricultural biomass flows (9). The agricultural biomass flows are presented based on EUROSTAT and FAOSTAT data (10, 11, and 12).

RESULTS

According to Gurria et.al (9), in 2015 the total supply of biomass in the EU-28 was 1.1 billion tons of dry matter - 95% produced domestically and 5% imported.

In the EU-28, agriculture generates the highest share of biomass production with approximately 68%, followed by forestry with 32%. Although the fishery sector has accumulated the lowest share of less than 1%, the sector is important because of its economic or nutritional values. **Figure 1** presents total the biomass flows in Bulgaria and the EU-28.

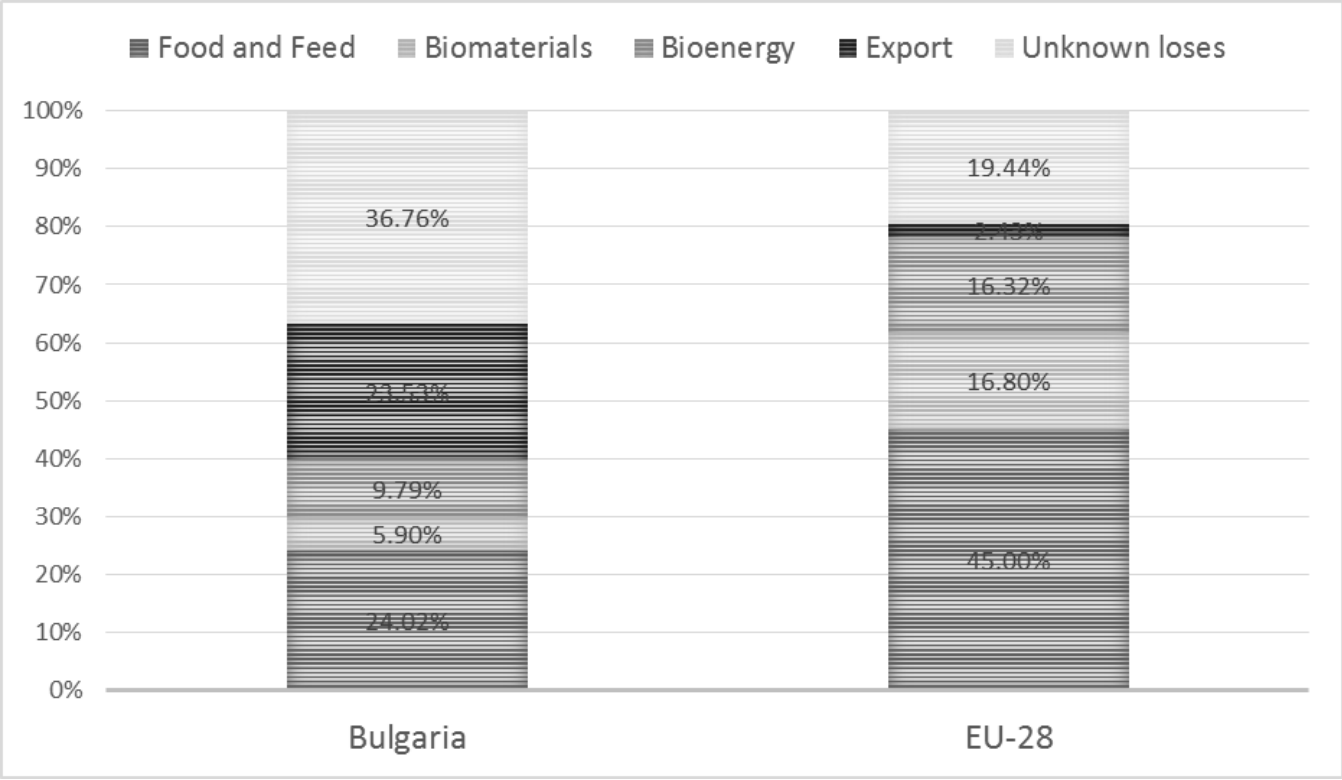

Figure 1. Total biomass flows by sector, 2017, (%)
Source: Own calculation based on (9)

Based on the data, several main differences between Bulgarian and EU-28 structure of biomass flows can be found. First, in the EU-28, the highest share of produced biomass is used for food and feed. The use of feed and food includes: aquatic food, plant-based food, animal-based food and animal feed and bedding (9). On the other hand, in Bulgaria the highest share of produced biomass is related to unknown loses, followed by food and feed. These trends show that the country has unrealised potential. Another major difference is related to export. Bulgaria has exported over 23% of the biomass produced, while in the EU-28 the percentage is below 3%. This result indicates that Bulgaria is a net exporter of biomass, rather than a producer of higher value-added products. In the EU more than 32% of the biomass supply is directed to bioenergy and biomaterials, while in Bulgaria biomass accounts for less than 15% of the biomaterials and energy production.

In 2017, the EU-28 agricultural biomass total supply is approximately 927 million tons of dry vegetal biomass equivalents. Bulgaria accounts for 6.7% of agricultural biomass supply in the EU. **Figure 2** presents the sources of agricultural biomass.

Figure 2. Sources of agricultural biomass, 2017, (%)

Source: (9)

Based on the data, it can be concluded that Bulgaria and the EU-28 have a similar structure of agricultural biomass sources. This biomass sources include: harvested crops, collected crop residues, grazed biomass and imports of agricultural products (9).

The crop production is 568 million tons of dry biomass in the EU-28 and represents more than 67% of the total agricultural biomass. France, Germany, Poland, Italy, Spain, the United Kingdom and Romania contribute to 75% of the economic and residual production. (13). According to the data, cereals has generated 50% of the crop biomass production, followed by fodder (27%) and oil crops (11%). The residues generate 108 million tdm of biomass and represent approximately 13% of biomass production. Grazing accounts for 116 million tons of biomass (13.73%). The imported biomass equivalents are around 135 million tdm. Compared to the EU-28, in Bulgaria the main differences are related to the higher share of

imports and residues as sources of agricultural biomass.

The results indicate that crop production has the highest potential for biomass supply. On the other hand, both residues left in the field and unused residues could potentially be used, which will lead to higher efficiency of agricultural biomass production. Agricultural biomass flows by sector are presented in **Figure 3**.

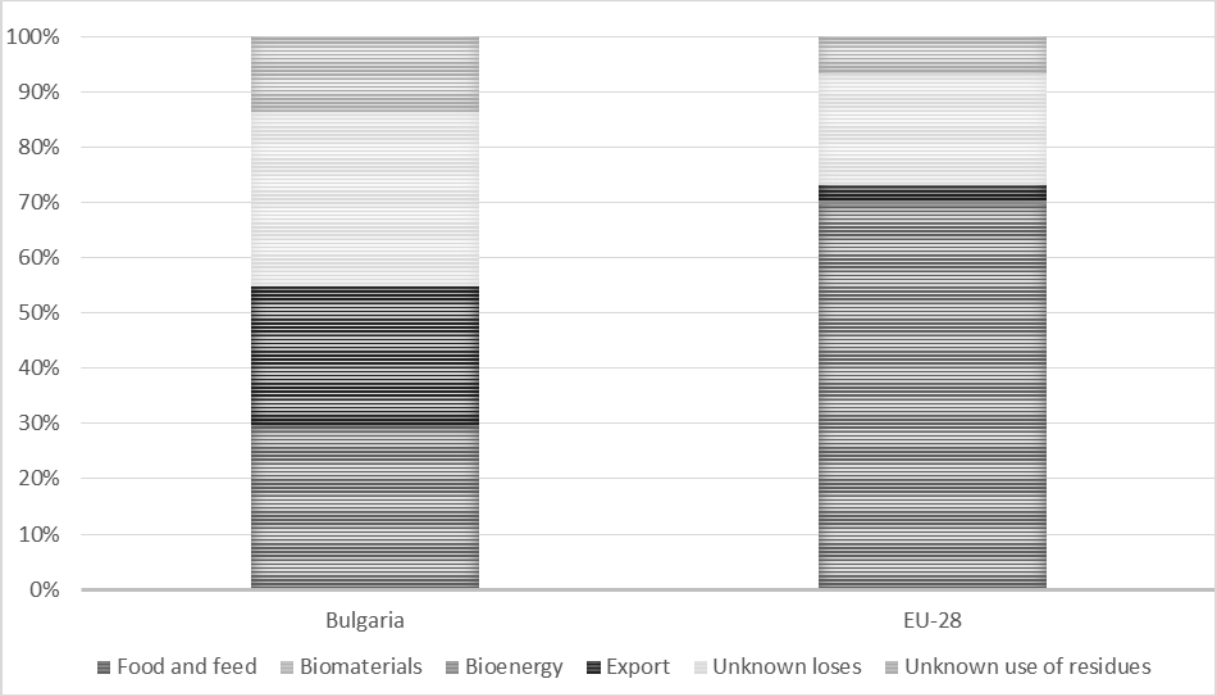

Figure 3. Biomass flows for agriculture by sector, 2017, (%)

Source: (9)

The data show serious differences in Bulgarian and EU-28 agricultural biomass flows structure. In Bulgaria the share of unknown loses is higher than in the EU-28. On average for the EU, only 33% (36 million tdm) of the collected residues are used for feed and food. The other share is used for biomaterials or energy, but most of them are lost or discarded and the amount of biomass used for each purpose cannot be estimated at this stage (9). Another important difference is the associated with the share of exported agricultural biomass. In Bulgaria this share is 25% compared to 2.66% in the EU-28.

These trends are in parallel with the total biomass flows and Bulgaria remains a net exporter of raw materials. In the EU-28 the highest share of agricultural biomass is used for food and feed, while in Bulgaria this share is similar to that for export. An insignificant part of agricultural biomass is directed to biomaterials and bioenergy purposes. It should be noted that data on biomaterials are difficult to estimate and most of the agricultural matter processed into biomaterials is used to feed farm animals. Data on biofuels are also associated with uncertainties (9).

CHALLENGES AND OPPORTUNITIES FOR BIOMASS USE

According to OECD (14) the main policy goal at global level is to transform generated biomass for production of biomaterials and bioenergy. The European Commission (15) emphasizes that bioenergy continues to be the main source of renewable energy in the EU and accounts for 60% of the total consumption. Forestry generated 60% of all EU internal biomass supplied for energy purposes, followed by agriculture with almost 27% and waste 12.4%. It can be concluded that the share of agricultural biomass in this area is still insignificant.

On the other hand, it is important to point out that the use of agricultural biomass for bioenergy and biomaterials is related not only to economic but also social and environmental challenges. Therefore, the main issue in this direction is linked to the question: how the expanded production of agricultural biomass can lead to sustainability?

The first question is related to the economic viability of agricultural biomass production. The competitiveness of the sector can be increasing by innovation, improved technologies, as well as vertical and horizontal integration of the value chain (16-19).

The main environmental benefits from the use of agricultural biomass are related to increased resource efficiency, waste recycling, and reduction of soil erosion, better water and air quality (14). However, there are also environmental costs associated with growing crops. For example, intensive production oilseed crops and cereals can lead to monocultural agriculture and problems with soil requirements and biodiversity. In addition, the extended use of agricultural biomass raises concerns related to food security.

Apart from environmental ones, there are also social challenges and opportunities. First, increased production of oilseeds and cereals could lead to changes, both for producers and consumers, mainly related to their price. In terms of employment, increasing biomass production could lead to job creation. On the other hand, it raises concerns related to the resource substitution and a shortage of skilled or semi-skilled workers in the agricultural sector. According to the OECD (14), social benefits and expenditures are the most difficult to understand and assess.

The question related to the sustainability of biomass supply and application is complex and depends on the methodological framework. It should be noted that some benefits and cost are difficult to assess. Another important challenge refers to the biomass waste and unknown losses along the supply chain.

From the perspective of the sustainability the effects of biomass supply and application should be considered. In this regard, sustainability criteria could limit the growth of biomass use for energy production (20).

CONCLUSIONS

It can be concluded that the comparative analysis of agricultural sources and flows of biomass shows some common features, but also differences between Bulgaria and the EU in certain directions.

Despite the opportunities for generating agricultural biomass, Bulgaria still fails to successfully realize its potential. The reasons are multifaceted – academic, administrative, organizational, technological, etc.

In regards to the sustainable and balanced use of biomass some recommendation can be outlined:
(1) Increasing the technological level of production in order to limit the unknown losses of biomass;
(2) Increasing the production capacity in order to limit the import of agricultural biomass in Bulgaria;
(3) Transformation of the structure of the Bulgarian biomass flow in order to obtain a higher value-added product, instead of being a net exporter.

The optimization of biomass supply and application requires an in-depth preliminary analysis of the economic, environmental and social costs and benefits. Food security and food safety, environmental conservation and social acceptability should be in the center of the discussion in this field and this could be the subject of further research.

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