

The European Commission's Knowledge Centre for Bioeconomy



Brief on agricultural biomass production¹

Key messages

- 1. The total annual agricultural biomass production in the European Union is estimated at 956 million tonnes (Mt) per year. 54% are primary products (grains, fruits, roots, tubers, etc.), i.e. economic production, and 46% are residues, e.g. leaves and stems (see section 1).
- 2. Cereals account for more than half of the total EU economic production of agricultural biomass and almost three quarters of total residue production in the EU (see section 2).
- 3. About 75% of the EU-28² economic and residue production comes from seven Member States: FR, DE, IT, PL, ES, RO and the UK (see section 3).
- 4. Uncertainties associated with residue production estimates are relatively large (see section 1).
- 5. In order to quantify the actual availability of residues for competitive uses, environmental sustainability requirements (e.g. soil conservation, biodiversity and the full range of ecosystem services in the agricultural sector) need to be accounted for (see knowledge gap No. 3).

1. How much agricultural biomass is produced in the European Union?

The total average agricultural biomass produced in the $EU-28^2$ for the period 2006-2015 is estimated at 956 million tonnes of dry matter per year (Mt/a). 514 Mt (54%) are primary products (biomass produced as grains, fruits, roots, tubers etc.), whose economic value is the principle motivation for their cultivation (economic production). The other 442 Mt of biomass (46%) are secondary products such as dry biomass

¹ This brief is based on the JRC Science for Policy report "Biomass production, supply, uses and flows in the European Union. First results from an integrated assessment" (Camia et al. 2018), unless stated otherwise.

² EU-28: Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (EL), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SI), Spain (ES), Sweden (SE), United Kingdom (UK).

from leaves and stems (residue production); these can also generate farm income, for instance when used for animal bedding or for bioenergy production³.

The production of agricultural biomass in the EU has increased slightly during the period 1998-2015, as shown in Figure 1. This is the result of a progressive increase in the yields of the main cereals (e.g. maize) due to improvements in agro-management, and a general expansion of the area used for oilseed cultivation. The inter-annual variability of total biomass production (Figure 1) is largely determined by weather conditions. Adverse weather extremes affected cereal growth in the main producing countries in the year 2003, which saw an extremely cold winter and a long heatwave during the summer, and in 2007, when Eastern Europe experienced a severe drought. These conditions resulted in relatively low total biomass production for those years. Conversely, 2004 and 2014 were the years with the highest levels of agricultural biomass production, as favourable weather conditions prevailed during the growing season in most Member States.

The production of agricultural residues is estimated from empirical models (see section 4). The confidence intervals in Figure 1 represent the uncertainties inherent to the model used. These uncertainties are relatively large – especially the upper interval – indicating the need for future improvements in the models.

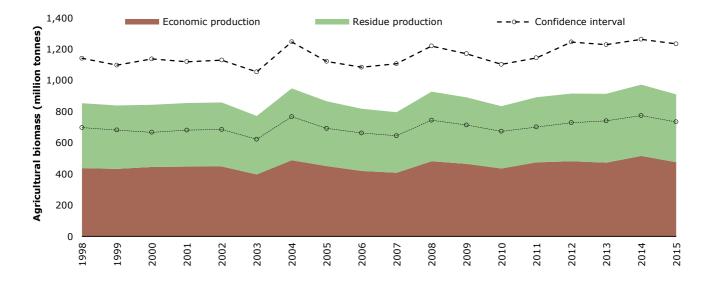


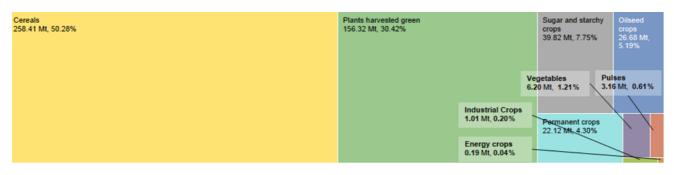
Figure 1: Evolution of annual agricultural biomass production (economic production and residues in Mt dry matter) in the EU-28 from 1998 to 2015. Dashed lines represent the 95% confidence intervals of the residue production in the EU-28.

2. Which crops contribute most to biomass production?

Cereals (258 Mt/a or 50%) and plants harvested green (156 Mt/a or 30%) dominate economic production, jointly accounting for about 80% of total biomass production, followed by sugar and starchy crops (40 Mt/a), and oilseed crops (27 Mt/a). Dedicated energy crops (crops grown exclusively for energy production, not included in any of the other crop groups) represent less than 0.1% of total biomass production. In its reports, Eurostat does not give the share of food or fodder crops (e.g. maize or rapeseed) used for the production of energy. See Figure 2 for a detailed breakdown.

With a share of 74% (329 Mt/a), cereals also dominate residue production. Oilseed crops contribute 17% (73 Mt/a) (see Figure 3 for detailed breakdown). In both of these crop groups, the biomass of residues is higher than economic production.

³ Residues are also essential for other uses, including ecosystem services such as maintaining organic carbon levels in soil and preventing soil erosion.



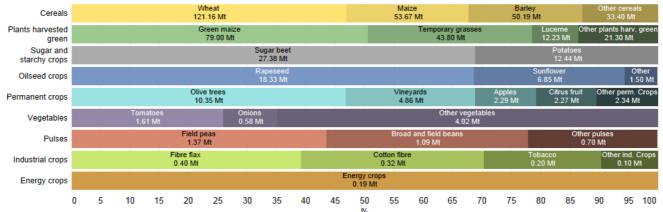


Figure 2: Breakdown of annual average EU-28 economic production of agricultural biomass by crop group (upper panel) and of each crop group by specific crop (lower panel) for the period 2006-2015, expressed in Mt of dry matter; total agricultural economic production: 514 Mt.

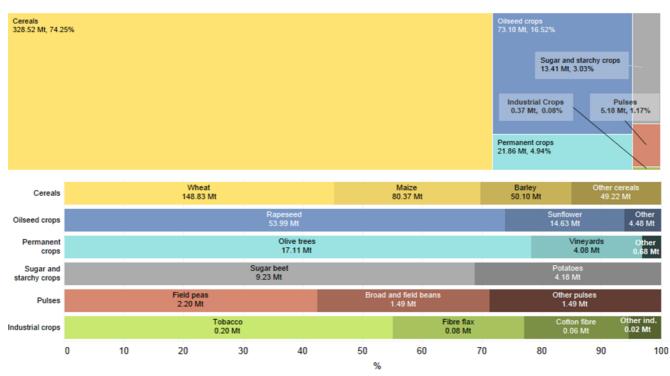


Figure 3: Breakdown of annual average EU-28 production of agricultural residue biomass by crop group (upper panel) and of each crop group by specific crop (lower panel) for the period 2006-2015, expressed in Mt of dry matter; total agricultural residue production: 442 Mt.

3. Where is agricultural biomass being produced?

About 75% of both the economic products and their residues (384 Mt/a and 323 Mt/a respectively) is produced in seven Member States: France, Germany, Poland, Italy, Spain, the UK and Romania.

France and Germany lead in terms of economic production (see Figure 4). In both countries, cereals contribute most, with 57 Mt/a and 40 Mt/a respectively, followed closely by plants harvested green (43 Mt/a and 33 Mt/a). In France, the production of fodder biomass mainly comes from temporary grasses, in Germany from green maize. Italy ranks third in economic production, with fodder crops contributing most, and a substantial contribution from permanent crops. Poland and Spain follow: in Poland cereals and fodder crops dominate, whereas most of the economic production in Spain comes from permanent crops (mainly olive trees).

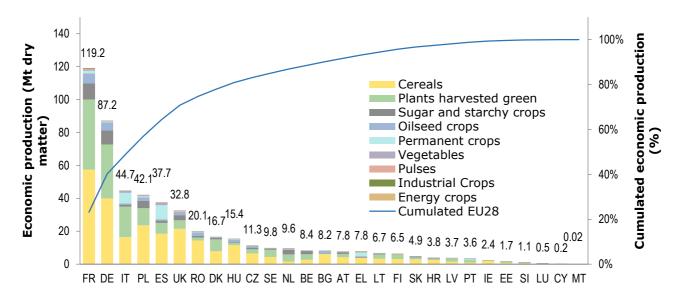


Figure 4: Economic production (left-hand axis) from the main crop groups per Member State, expressed in Mt of dry matter per year; the right-hand axis shows the cumulative percentages of total EU-28 economic production; total agricultural economic production: 514 Mt.

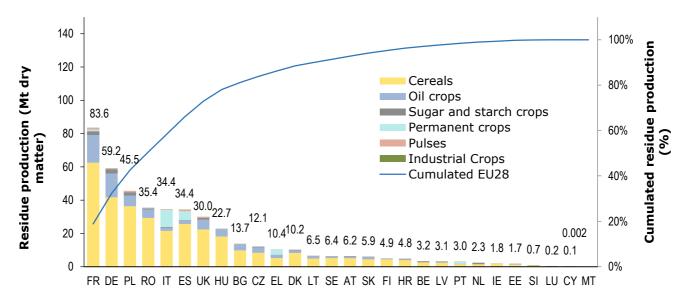


Figure 5: Residue production (left-hand axis) from the main crop groups per Member State, expressed in Mt of dry matter per year; the right-hand axis shows the cumulative percentages of total EU-28 residue production; total agricultural residue production: 442 Mt.

France (84 Mt/a) and Germany (60 Mt/a) are also the main EU producers of residue biomass (Figure 5). In both countries, cereals represent 70-75%, followed by oilseeds. Poland and Romania rank third and fourth. Cereals represent 80% of total residue production in both countries, followed by oilseeds. In Poland, most of the residues come from winter cereals such as triticale and rye, in Romania from maize. As maize produces high amounts of biomass in leaves and stems, Romania is the fourth largest residue producer in the EU.

4. Methodology

Economic production of agricultural biomass is assessed by processing crop production statistics compiled by Eurostat and the Member States to generate a consistent economic production archive of all commodities for the EU-28 across all administrative levels (NUTS 0-3). On the other hand, there are no systematic agricultural statistics for residue production. The estimates are deduced from crop production figures using empirical models, established from an extensive dataset of observations for each individual crop.

Knowledge gaps

- 1. There are no systematic figures on residue production in agricultural statistics. Therefore, residue production is deduced from economic production using empirical models. These do not account for differences linked to genetic factors (varietal differences), agro-climatic conditions, and agro-management practices (e.g. irrigation, fertilisation, etc.).
- 2. There is a lack of data on residue collection practices and current use of crop residues.
- 3. In order to quantify the actual availability of residues for competitive uses, environmental sustainability requirements (e.g. soil conservation, biodiversity and the full range of ecosystem services in the agricultural sector) need to be accounted for. There is as yet no agreed methodology to assess the residue biomass needed to satisfy such requirements⁴.

References

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⁴ For information on the quantification of residues for competitive uses see e.g. Scarlat et al. (2010), Monforti et al. (2013) and Ronzon et al. (2017). An example of sustainability criteria that may be used in quantifying actual availability of residues for competitive uses is covered by the work of Monforti et al. (2015) that estimates available agricultural residues without impacting Soil Organic Carbon (SOC).

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