IDENTIFICATION AND DEVELOPMENT OF CROPS FOR ENERGY PRODUCTION

Summary of Topic 1 „Identification and development of crops for energy production"

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In his introductory lecture „Plant Breeding Potential to Improve Energy Crops for the Use in Biogas"; Wolfgang Friedt, Department of Plant Breeding, Justus Liebig University, Giessen, Germany highlighted goals and recent developments in oil- and starch containing crop plants. Considering yield, yield stability and product quality, the grain yields could be constantly increased during the last decades by roughly 0.1 t per ha and year. Nevertheless a further increase of yields will be obtained through improved agronomy (e.g. crop rotation) and plant breeding technologies. Advanced hybrid breeding and gene technologies will provide taylor made plants with improved yields and protection against environmental stress (e.g. drought resistance).

Since the mean methane yield of common crops (e.g. corn, maize, grass, silage) is more or less analogue (i.e. 300 Nl CH_4/kg VSS), the crop yield of agricultural systems is the most important impact on the productivity of crop to biogas systems. As a further important influence of cultivation, the harvest time also essentially controls the achievable biogas yield. Depending on crops and climate, the optimum harvest time has to be selected from case to case.

Due to various industrial uses (as well as food use) of starch and oil crops, agricultural land will soon become limiting in industrialised countries like Germany, The Netherlands or the UK. It has to be worked out carefully how much energy, industrial raw materials and food will be producible through sustainable agricultural systems.

In his contribution "Switchgrass and Miscanthus as Energy Crops – Agricultural aspects", Wolter Elbersen, Wageningen University, The Netherlands, worked out general properties and advantages of perennial compared to annual crops. While Miscanthus yields 12-35 t DM per ha and year, switchgrass yields are slightly lower i.e. 10-30 t DM per ha and year). Fertiliser input (50-100 kg N / ha), adaptation range (cool and warm regions) and low water use are comparable in both plants. Switchgrass shows better erosion control and due to seed propagation, lower establishment risk and cultivation cost.

As a conclusion the author proposed preferential use of Switchgrass, except under good growth conditions where Miscanthus is superior due to it`s higher yields.

In general, both, Miscanthus and Switchgrass, allow advantageous delayed harvest systems, resulting in decreased water contents, translocation of nutrients to below ground and lower nutrient off take. As a result, the biomass harvested is lower in free sugars, ash, but shows higher fibre (lignocellulose) content. It is generally considered as low quality biomass for anaerobic digestion systems. As possible solutions for improved biomass digestibility, earlier harvest, higher fertilisation rates and silage storage systems were proposed.

In her contribution "Biodiversity Impacts of Enhanced Energy Crop Production in EU Farmlands" Berien Elbersen, Wageningen University, The Netherlands, worked out 3 scenarios from low to high impacts. The study is based on the EU targets for renewable energy for the years 2010 and 2020. Land requirements to fulfil the targets set, were estimated for the EU 15 as well as the 10 new member states and the 2 candidate countries Romania and Bulgaria. As to be expected highest agricultural land requirements resulted for Spain, Italy, France and Germany (about 2-3 million ha per country), respectively Poland and Romania (about 600,000-700,000 ha per country). In the EU 15, about 13 % of the currently utilised agricultural land will be required for energy crop production by 2010.

Generally biodiversity impacts depend on the extent of land use, the crop types grown, required land use conversions, effects on landscape diversity and habitat fragmentation, effects on soil organisms, birds, mammals, invertebrates, other plants, as well as on effects on water- and soil quality.

Three groups of energy crops, resulting in different biodiversity impacts, were studied: (1) sugar- and starch containing beets and potatoes, (2) Oil- and starch containing sun-flower, rape, cereals, sorghum, (3) Mainly lignocellulose containing coppice, miscanthus, switchgrass and red canary grass.

In the scenario study it could be shown, that the impacts of future energy crop production on biodiversity strongly depend on the existing agricultural structure and land use in each individual country. The more set aside- and fallow land, or low input agricultural land available, the higher the impacts on biodiversity will be. Effects are not equally distributed. Highest impacts occur in countries like Portugal, Spain, Italy, Slovenia, Estonia and Bulgaria. Biodiversity impacts from increased biomass demand are likely to be relatively small in other countries.

It was also concluded that choosing the right biomass crop depending on what land is being converted will be most important. Furthermore avoiding monotonisation of the landscape and introduction of a mix of biomass crops (landscape diversity) will be required. Finally converting of low intensity farmland to biomass crop production should be avoided.