Bioenergy – The Role of Plant Breeding and the Seed Industry

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Introduction

Bioenergy from plants is a form of renewable energy derived from crops that have the ability to store sunlight as chemical energy. Different biomasses serve as feedstock for the three energy carriers electrical and thermal energy and transportation fuel. Furthermore it should also be noted that only biomass has the potential to be used by the chemical industry as alternative feedstock for the nowadays oil-based refineries.

Today, specific crops, so-called energy crops are grown on agricultural land as biomass for the supply of bioenergy.

The most used strategies are either to grow crops high in starch, sugar and cellulose (hemicellulose), or alternatively to grow crops high in oil. In the first case, the starch, sugar or cellulose is fermented to produce ethanol or biogas (methane). In the second case the oil itself or the vegetable methyl ester (biodiesel - obtained via the transesterification process) is used as a diesel substitute.

Another way of producing bioenergy is the traditional way of using wood and its by-products as solid fuel for heating. New production processes with a higher energy use efficiency are being developed involving the use of the total aboveground biomass. Cellulosic and lignocellulosic biomasses, the most abundant plant materials on earth, which can be found in agricultural crops and biomass residues, straw, or non-food crops (e.g. perennial grasses such as switchgrass and miscanthus) come into the focus for sustainable and energy-efficient bioenergy production.

New opportunities for the global demand of energy

There is a growing global demand for energy and more and more countries find it necessary to diversify their energy supplies. This has several reasons: it improves their energy security, it has feasible economical benefits and it has potential environmental effects such as the reduction of greenhouse gas emissions.

For centuries the seed industry has carried out research and developed varieties for food and feed. ISF and its members see the developments around bioenergy as a new opportunity and wish to clarify that these developments are a response to the changing needs of a growing population. Improved specific varieties for biomass production are one of the main answers to this increased demand.

Bioenergy and their associated technologies and policies are generating a very active debate between and within governments, businesses, trade unions, NGOs and research institutions. There are a range of considerations regarding bioenergy, including the potential for commercial scale production, the potential of advanced bioenergy conversion technologies, and their potential local and international impacts on food prices, land use, transportation systems and vehicles, climate change and society.

Contribution of plant breeding to bioenergy supply

The different challenges related to the use of bioenergy require integrated and cooperative solutions. The plant breeding industry has invaluable expert knowledge on topics such as genetics, biotechnology, food and agriculture, which are considered to be crucial for future efficient bioenergy production.

Plant breeding efforts are underway to select germplasm with the highest output for the supply of sustainable bioenergy.

Some of the different bioenergy production systems are currently based upon starch- and sugar-producing feedstock such as maize, sugarcane, sugarbeets, and cereals while biodiesel uses rapeseed, sunflower, soy and palm oil as feedstock. Next generation technologies based upon non-food feedstock are getting closer to the market but are not yet commercial. There has been considerable international attention on the expanded use of agricultural crops for the supply of bioenergy and the impact on prices of food and livestock feed in both developed and developing countries. Plant breeding for bioenergy sees its role in providing choices to farmers and industry to produce energy in the most efficient way with as little land resources possible.

Effects on natural resources

Plant breeding provides every year varieties with a 1-2 % higher yield potential, which certainly leads to a decrease in land-use for the same global agricultural productivity. ISF members will continue to further improve these varieties with increased crop yields and use the genetic gain to reduce the amount of land needed for food and feed production.

The cultivation of marginal land that is currently not used for agricultural production presents another way to avoid competition with food and feed production. Breeders currently invest in research and develop plants with e.g. higher drought and salt tolerances such as sorghum and jatropha. Drought tolerant varieties require less water for a good harvest. The development of new drought tolerant crops and varieties fits perfectly with the strategy of sustainable production and the extended agricultural production to marginal land. Public-private partnerships and international collaboration will play key roles in advancing these varieties and their role in the production of food, feed or bioenergy.

Concluding remarks

ISF herewith confirms that its members see bioenergy as one viable and economic alternative for the partial replacement of fossil fuels.

Plant breeders provide a wide range of crops and varieties for bioenergy to use natural resources in the most efficient way and minimize competition between food, feed and energy.

The further extension of biomass production to marginal and currently not used land depicts one way to secure the overall demands of agricultural production.

The further development of production systems for bioenergy will lead to a diversification of energy forms and the adaptation to site-specific conditions. Globally used, bioenergy may increase the independence from fossil fuels. Improved varieties used for bioenergy will result in economic, social and environmental benefits for developed and developing countries alike.