Alternative energy sources

Plants Instead of Coal

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During the past two centuries, humans have switched from plant-derived energy materials to coal and oil. But as we gradually exhaust our supplies of such fossil fuels, the time for renewable energy sources is approaching

Unlike fossil fuels, renewable raw materials will have multifaceted beneficial effects, especially as energy sources. For farmers, energy plants can offer a way of coping with slumps on the food crop market. Renewables can also help lower unemployment in rural areas and stem migration from the countryside to already overcrowded cities. Another important reason why science is interested in new, renewable plant materials is their impact on greenhouse gasses, due to their natural ability to make use of CO_2 to build their tissue. Furthermore, emissions of harmful gasses (CO, CO_2, SOx, NOx) and ash that contribute to the greenhouse effect are significantly lower when plant materials are used to produce energy instead of fossil fuels. This is possible because producing energy from biomass is a natural and almost closed cycle, where even ash, a product of combustion, can return to the fields as fertilizer.

S. Jeżowski

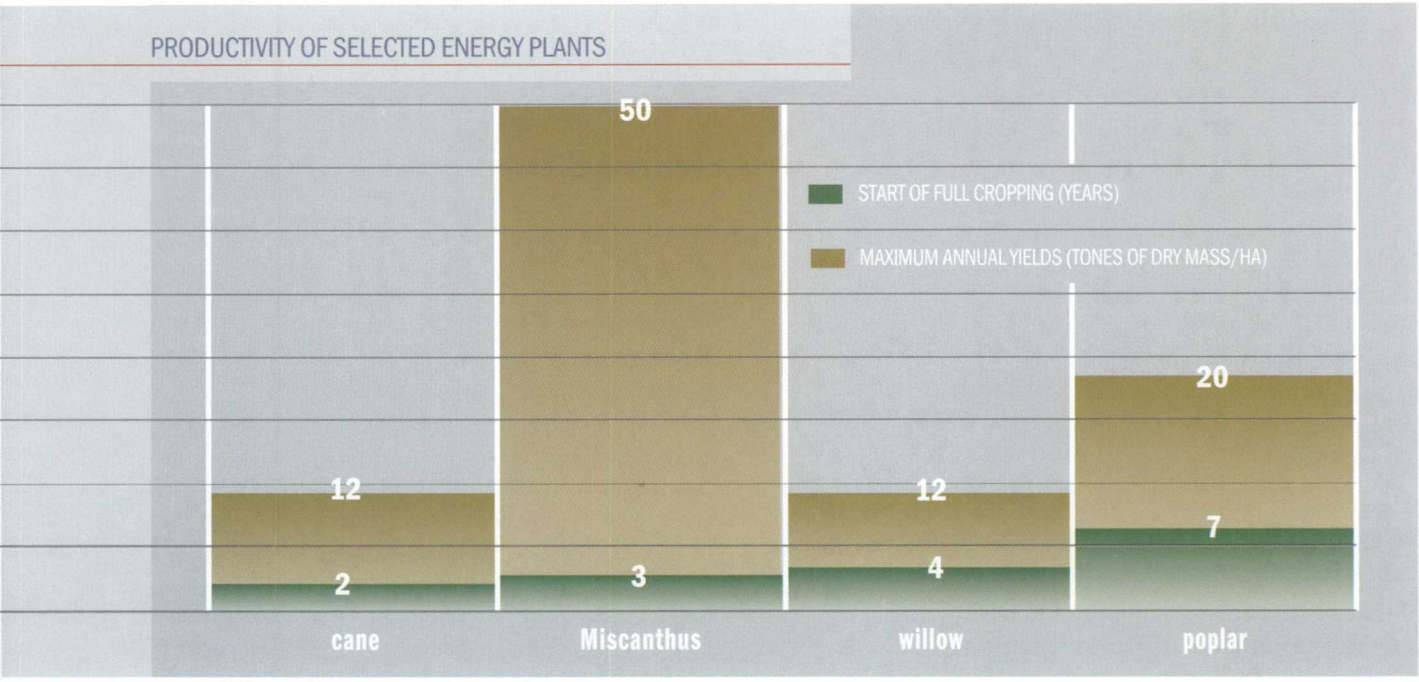
***Miscanthus* grass – the leader among energy plants**

But what do we mean by the term "energy plants"? This refers to all species of plants that have the ability to intensively accumulate oils or carbohydrates as an initial product, which can later be used as a substrate for the industrial production of liquid fuels. For example, we can obtain alcohol (methanol or ethanol) from cellulose or starch. And plant oils are an excellent raw material for producing biofuels. Parts of plants that contain lignocelluloses can provide energy directly, when burned (in the form of balers, briquettes, pallets) or indirectly, after being converted to either liquid fuel (high-octane petrol, diesel oil, hydrogen) or natural gas. This group of plants includes annual species such as cereals, maize, sunflower, topinambur, sorghum, rape and the like; fast-growing (perennial) species such as reed plants *(Miscanthus sinensis, Arundo donax, Spartina pectinata)*; and woody plants with a perennial harvest rhythm, such as the wicker or poplar.

Biomass seems to be a perfect energy source: one that is reliable, cheap, reduces the greenhouse effect, and creates new job opportunities in rural areas

Energetic grasslands

Many authors confirm that one of the most important energy plants is the grass *Miscanthus x giganteus*. The reasons for the great interest in this plant lie in its rapid growth and efficient production of dry matter, which can reach up to 30-50 tons per hectare (each year, for 15-20 years after planting), making *Miscanthus x giganteus* the leader among energy plants.



Our country is on its way toward joining the European Union. Probably one of our most important problems is adapting Polish agriculture to meet EU requirements. We will probably face difficulties with the planned further increase of uncultivated land area (as was the case for the present EU countries). A special program promoting alternative plants as a source of renewable energy may be the answer. Such a program might include the introduction of energy plants, which aside from providing cheap and clean energy would also maintain the biological activity of unused land. Moreover, alternative plants can be cultivated in areas that have been contaminated by industry. Science holds particularly high hopes in the use of *Salix viminalis* and *Miscanthus x giganteus* as energy plants.

Energy willows, which have been cultivated for a relatively short time, include Scandinavian varieties. These have mainly been selected by Swedes, but a lot of initial material comes from Poland. This is why research on these species has been underway for the past three years at the PAN Institute of Plant Genetics. Our aim is to obtain native, high cropping varieties of willow, adapted to suit our climatic conditions. We expect that these varieties can yield from 20 to 30 tons of dry matter per hectare.

Poland as a biopower station

For a few years, we have also been doing research on *Miscanthus x giganteus* at our Institute. Crops from experimental parcels hold great promise as a source of renewable energy. It is possible to obtain from 20 to 40 tons of dry matter per hectare, the equivalent of 15-30 tons of coal, or 10,000 liters of methanol! And keep in mind that methanol is what will probably replace petrol within the next 10-15 years. Internal combustion engines will be replaced by fuel cells supplied with methanol, which will yield hydrogen. Hydrogen cells will generate electricity, which will power electric vehicles. Cars driven by electric energy will only give off distilled water and carbon dioxide. In other words, they will be environmentally friendly.

The energy crops harvested from one hectare can produce energy equivalent of 15-30 tons of coal or 10 000 liters of methanol!

This is why we feel that our research is becoming more and more important. Our successes in this field include developing efficient techniques for the micropropagation and vegetative propagation of *Miscanthus x giganteus*. This is unfortunately a sterile plant, one that does not produce seeds. One of our research aims, therefore, is to restore this plant's fertility, which should ultimately make easy propagation by seed possible. If we manage to make energy plant cultivation customary in Poland, we could become the main producer and also exporter of "green" energy to all the European Union countries.

Further reading:

El Basam N. (1996). *Renewable energy - potential energy crop for Europe and the Mediterranean region.* Reu Technical Series 46, Food and Agriculture Organization of the United Nations, Rome

Scheer H. (1993) *Sonnenstrategie - Politik ohne Alternative.* Piper Verlag. Munich