OPTIMIZATION OF THE INTERFACE BETWEEN AGRARIAN LAND USE AND UTILIZATION OF RENEWABLE AGRARIAN ENERGY SOURCES (OPAL)

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Energy balance and economic performance of power, heat and fuel production from agrarian resources can be significantly improved by more intelligent interfaces. The project is to create a decision support tool for land-use adapted choice of technology, choice of plant dimension, crop rotation, fertilisation management and increase of sustainability.

The project proposes to elaborate a comprehensive decision support tool for optimisation of investments in the sectors agriculture and renewable energy. Up to now the type of energy production plant (heating plant, bio-gas production plant and production of ethanol) is determined by the spatial distribution of the project initiators. The interaction of energy production and traditional farming will become increasingly complex – considering a growing net of production facilities. Synergies can be used, lack of resources should be avoided, transport distances have to be kept to a minimum to keep the facilities economical competitive, and to avoid a negative energy balance.

Therefore the decision support tool will cover all relevant impacts, to cover the complexity of the problem. The tool will be available as software, accessible online either via a thin-client (common web-browser), or a thick-client, which will be offered for download. To achieve software of good usability, which is user-friendly, will be a priority. Since the target group consists mainly of investors, sponsors, and licensing institutions, user knowledge about the technology and terminology of the field is assumed, but users should not be concerned with the algorithms built in. Continuous development and maintenance of the Software is envisaged. The Software will be offered internationally, but will be less suitable for the Mediterranean regions due to the very different crops there.

Optimisation between agrarian and energetic land use to be resolved is a key issue of the project. In this context avoiding competition between food and energy production from same crops is essential.

A possible solution of the problem for crop-land is a follow up utilisation of the same area and in the same growing season by primary crops for food production and secondary crops for energy production (see figure 1). In table 1 the targeted conditions for energetic use of secondary crop are presented. Different crop mixtures tested for energetic use so far are

shown in table 2. In picture 1 a flowering secondary crop mixture can be seen. In any case thorough soil and fertilisation management are preconditions for large energetic crop yields.

Concerning optimised grass-land use a similar approach can be taken for animal feed and energy production on the same area (see figure 2).

The project will be finished end of year 2010.

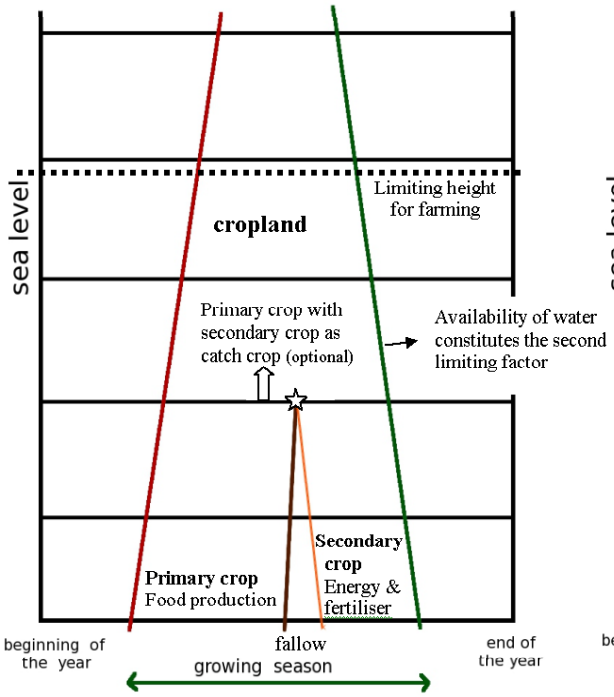

Figure 1: Optimisation of agrarian land use for food and energy (schematic)

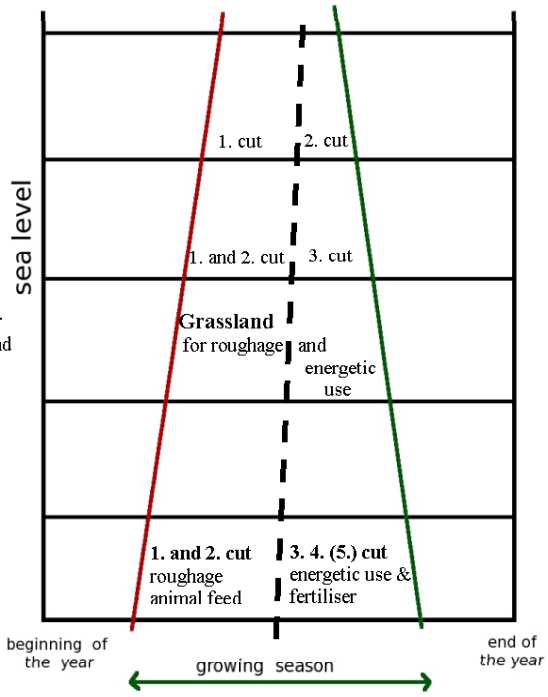

Figure 2: Optimisation of grass-land use for animal feed and energy (schematic)

Crop sowing	Growth period	Fertilisation	Crop yield
Sowing of secondary crop needs to be performed **within 48h** after harvesting the primary crop	A growth period of at least **90 days** is essential	Fertilisation with **biomass digestate** is necessary	The target crop yield is **7t / ha** of dry matter, which equals **2500m³ of CH_4**.

Table 1: Targets for sustainable achievement of energetic yields from secondary crop

Plant species Secondary crop	**Soil cultivation**	**Fertilisation digestate** [kg N]	**Max. crop yield** [t dm/ha]
Cruciferous plant	Grubber 30 cm depth	80	7,8
Spring grain	Grubber 25 cm depth	80-100	6,8
Sunflower / millet mixture	Plough, Seedbedcombi EKS	90	6,2

Table 2: Crop yields observed by ABEL RETEC (H. Koch) at several sites with different types of cultivation (table modified)

Picture 1: Vegetation of secondary crop mixture (sudan grass, sunflower, sorghum) before harvesting, Upper Austria, 2009