

## FUEL PRODUCTION WITH LOCAL GRASSES AND MISCANTHUS

Vito Mediavilla, Joseph Lehmann and Hans Stünzi, Swiss Federal Research Station for Agroecology and Agriculture, Zürich-Reckenholz, CH-8046 Zurich

### Abstract

In an interdisciplinary project the possibility of producing energy from biomass was studied. Results of five year field trials with the perennial grasses timothy (*Phleum pratense*), reed canary grass (*Phalaris arundinacea*) and meadow foxtail (*Alopecurus pratense*) and with miscanthus (*Miscanthus x giganteus*) carried out in two localities of North Switzerland are reported here. The yield of local grasses varied between 19 (first year) and 6 (year 5) tons DM/ha. Yield were highest with timothy and reed canary grass. Miscanthus yields reached up to 20 to DM/ha after year 5. Because of its low ash content showed miscanthus better combustion characteristic (ash melting temperature, emission).

### Introduction

Between 1992 and 1996 the Swiss Department of Energy has promoted an interdisciplinary project with the aim to study the possibility of producing energy from agricultural biomass in an environmentally sustainable way. The study focused on biomass from extensive Swiss grassland types, on productive perennial native grasses, on miscanthus and on coppice. We report here only about the grasses and miscanthus.

### Materials and methods

The chosen cultivation philosophy was the low input system. It means that no pesticides (exception first year) was used. The input of energy was low, and instead of mineral, organic manure was used. Grass cultivation was extensive with only two cuts per year.

The planting was done in 1992 on randomized field plots (36 m<sup>2</sup>) with 3 and 4 repetitions. Trial locations were in North Switzerland. Name and climatic parameters are given in Tab. 1. Fuel analyses was done according Mediavilla et al. (1997).

**Tab. 1. Locations and climatic parameters of trials.**

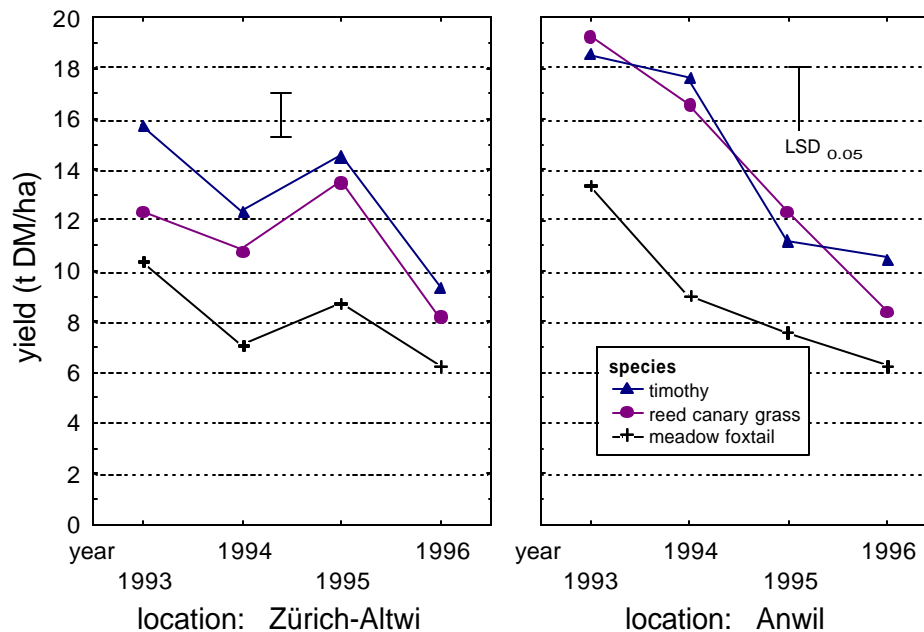
	Zürich-Altwi	Anwil
Temperature mean (°C)	7.5	7.5
Rain fall (mm)	1006	944
Elevation (m)	487	588

As **perennial grasses** we tested timothy (*Phleum pratense*), reed canary grass (*Phalaris arundinacea*) and meadow foxtail (*Alopecurus pratense*). They are well adapted to local Swiss conditions and have a good winter survival. Crop establishment is fast and no weed problems or diseases are usually know. Harvest is possible with common hay technology during summer and fall. The dry matter content is between 75% and 85%.

**Miscanthus** is a perennial high yielding grass, with origin South East Asia. The miscanthus plant resembles morphological sugar cane. Its propagation is done with micro and rhizome methods, because no fertile seeds are know. Risk of winter failure is high in the first year, especially if plant establishment is poor and under hardy local conditions. The experience shows that local conditions are very important, in particular if no good development is possible. Because of slow crop establishment weed problems in first year are possible. Herbicides spray were done. Diseases posed no problem. Harvest was carried out in spring march. In Switzerland about 300 hectares miscanthus are cultivated in 1997 for packing and peat substitution. Miscanthus is harvested in early spring as bales, pellets or chips. Dry matter content in march varied usually between 70% and 80%.

## Results and discussion

The yield level of local grasses and miscanthus was similar. Local grasses produced between 19 (first year) and 6 (year 5) tons DM/ha. Meadow foxtail was outyielded by timothy and reed canary grass (Fig. 1). Miscanthus yields increased up to 20 to DM/ha after year 5 and was not influenced by fertilisation (Fig. 3). No important winter failure was observed.

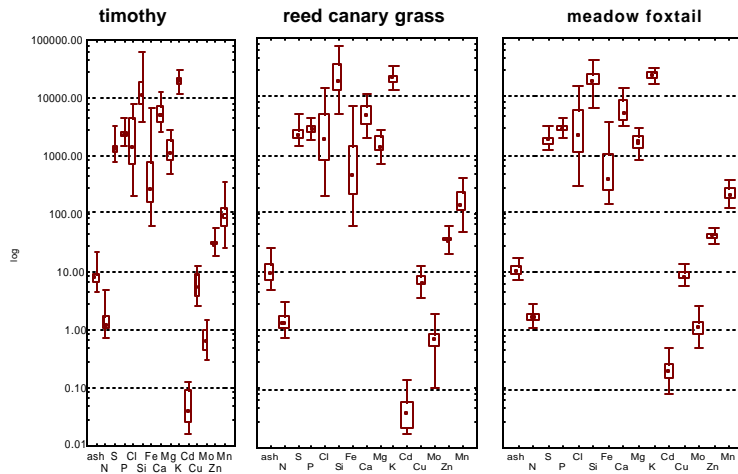


**Fig. 1. Yield of local grasses during years 2 to 5 (fertilisation with slurry 75-90 kg NH<sub>4</sub>/ha) and fuel quality.**

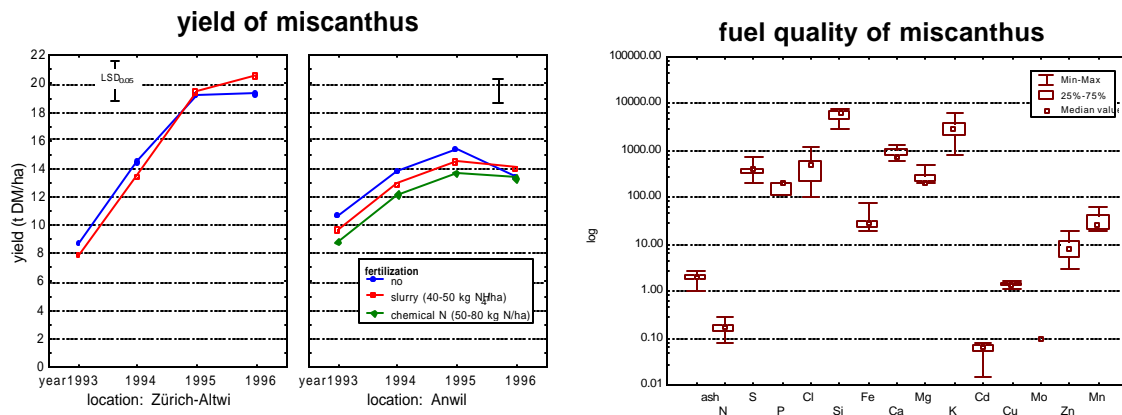
The mineral contents of miscanthus (2% ash DM) were considerably lower than of local grasses (10% ash DM) (Fig. 2 and 3). Specially Si, K, N, Cl and Cd content were lower in miscanthus plants. Dry matter content and heating value were similar. So that miscanthus shows better combustion characteristic (lower mineral content, higher ash melting temperature, reduced emission).

## **Conclusions**

Timothy and reed canary grass yielded high amounts of biomass even under moderate intensive management. Miscanthus showed similar high yield potential. Because of its lower ash and nitrogen content and the better burning characteristics miscanthus makes a better fuel for combustion.



**Fig. 2. Fuel quality of local grasses during years 2 to 5 (ash and N %DM, S to Mn ppm).**



**Fig. 3. Yield of miscanthus during years 2 to 5 and fuel quality (ash and N %DM, S to Mn ppm).**

## References

Mediavilla V., Lehmann J., Meister E. and Stünzi H., 1997. Biomasseproduktion mit Chinaschilf und einheimischen Gräsern. Agrarforschung 4 (7): 295-298.