

Solid biofuel and biogas production from a grassland-willow alley cropping system

Miriam Ehret, Rüdiger Graß and Michael Wachendorf
 University of Kassel

Background

Worldwide the demand for renewable energy is rising and biogenic energy carriers play an important role in bioenergy provision. However, increase and intensification of biomass production for energetic use has already shown adverse impacts on agroecosystems, e.g., biodiversity losses, nitrate leaching, and erosion. Agroforestry systems obtain the potential to provide biogenic energy carriers and to diversify the biomass production in an environmentally sound way.

Aim of the study

The project BESTGRAS assessed spatial and temporal yield distributions of willows and grassland in a young agroforestry system from 2011–2013. Further, the energetic potential of grassland biomass grown in the agroforestry system was investigated.



Fig. 1. Willow-grassland agroforestry system

Material and Methods

- Agroforestry system in an alley cropping design, established in 2011
- Split-split-plot design
- 2 grassland mixtures (clover/grass and a diversity oriented mixture)
- 2 fertilization levels (0 kg N ha⁻¹, 100kg N ha⁻¹)
- 3 conversion technologies

Results

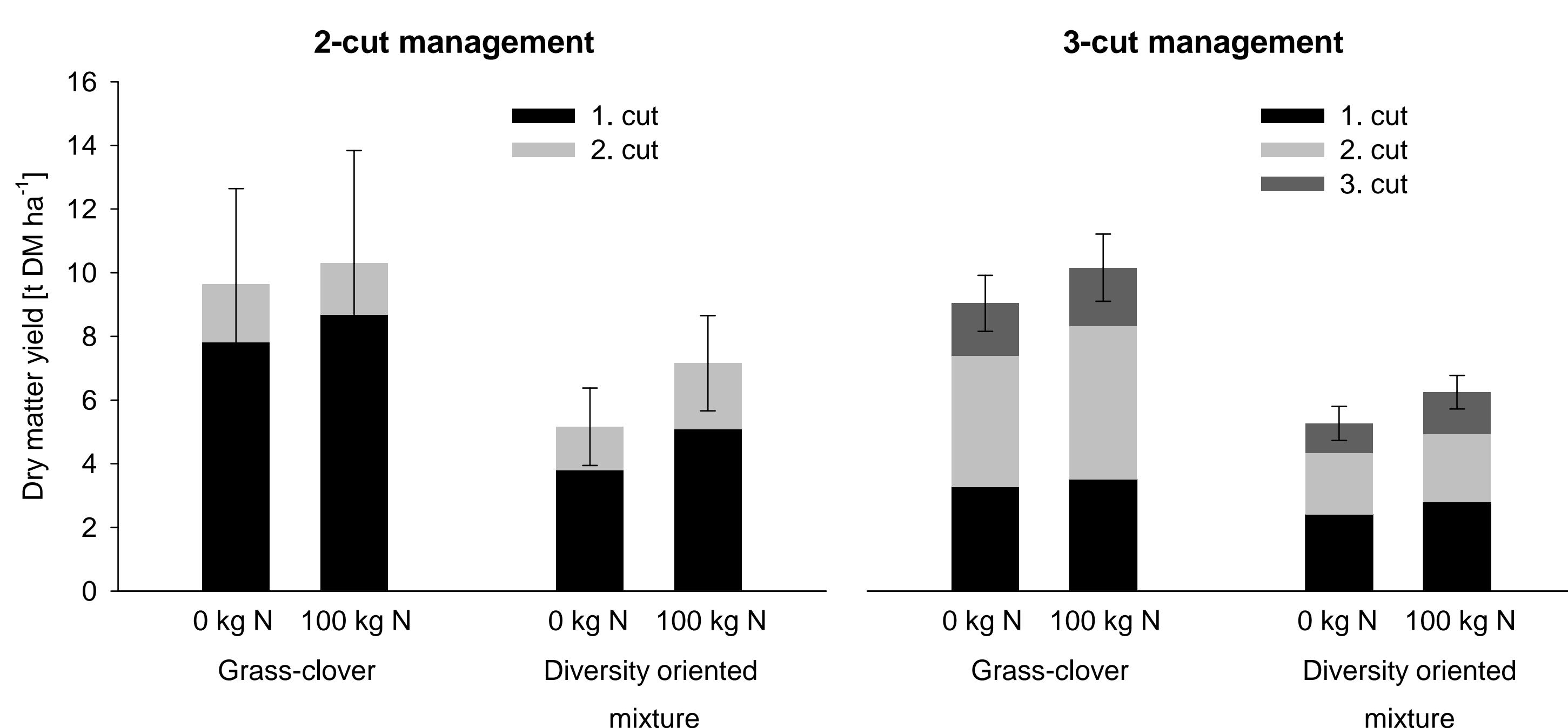


Fig. 2 Annual dry matter yields of grass-clover and diversity oriented mixture in 2-cut and 3-cut management with fertilized and unfertilized treatments from 2013

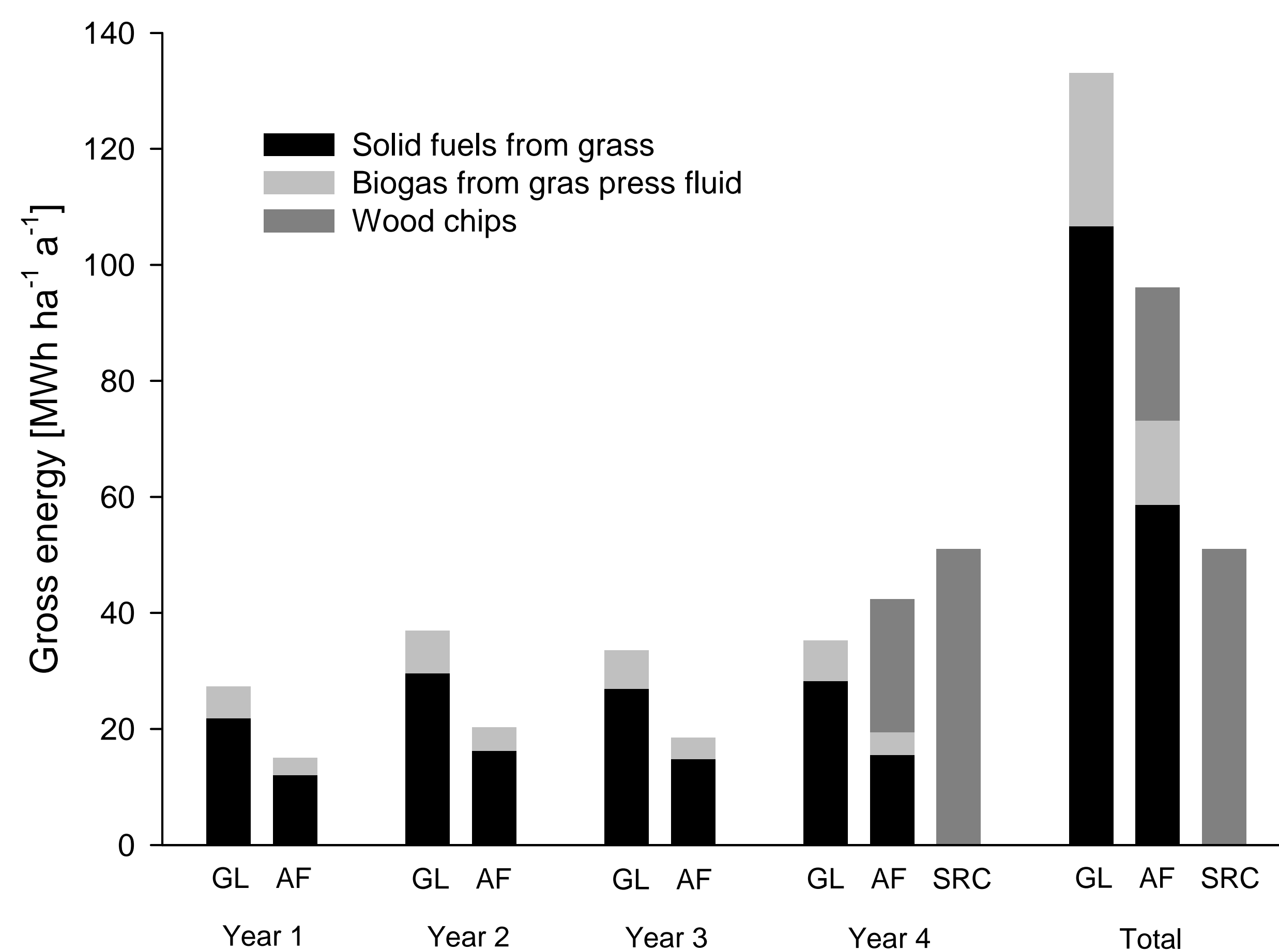


Fig. 3 Gross energy yields of monocropped grassland (GL), agroforestry of grassland and willows (AF), monocropped willows (KUP) over a 4 year period after establishment in 2011. Data from year 1 to 4 based on measurement, year 4 extrapolated.

- Grass-clover achieved higher dry matter yields
- Fertilization had positive effect on yield
- Diversity mixture reached higher yields in 2-cut management

- Optimized biomass production for energetic use in the agroforestry system
- Solid fuels and press fluids from grass (by IFBB procedure) as well as wood chips from willows

Conclusion

The field experiments from 2011-2013 showed a low growth and yield performance of the fast-growing willows during the establishment phase. A more continuous yield distribution might be expected by the combination of grassland and willows in an agroforestry system. The present agroforestry system provided annual gross energy yields between 20 and 40 MWh ha⁻¹ a⁻¹.

