

Switchgrass (*Panicum virgatum* L.) A perennial biomass grass for efficient production of feedstock for the biobased economy

Authors: Wolter Elbersen, Ronald Poppens and Rob Bakker



English name: Switchgrass

Latin name: *Panicum virgatum* L.

Origin: North America

Occurrence: Mainly in North America and it is tested and developed worldwide as a low cost, low impact lignocellulosic biomass crop.

Current uses: Fodder, ornamental, erosion control and land reclamation. In development as a biomass crop for fuels and chemicals.

Growth habit: Perennial rhizomatous C₄ grass up to 2.5 meters in height.

Growth cycle: Propagated by seed with a stand life of 10 to 20 years when used for biomass production in a delayed harvest system

Ecological demands (climate, soil, etc.): Wide adaptation. Performs best on good, well drained soils but will also be productive under low pH conditions and soils that are undated temporarily.

Yields: Between 8 and 14 tons DM per ha per year at higher latitudes up to 20 tons DM per ha at lower latitudes.

Biobased applications/conversion and quality aspects: Switchgrass is a model biomass crop which has been developed over the last 25 years and that has been introduced in Europe and other parts of the world. The quality for thermal conversion is worse than for wood and better than for most herbaceous biomass types such as straw.

Costs: Cost estimates start at €35,- per ton DM for local delivery. Cost depend strongly on yields and cost of land.

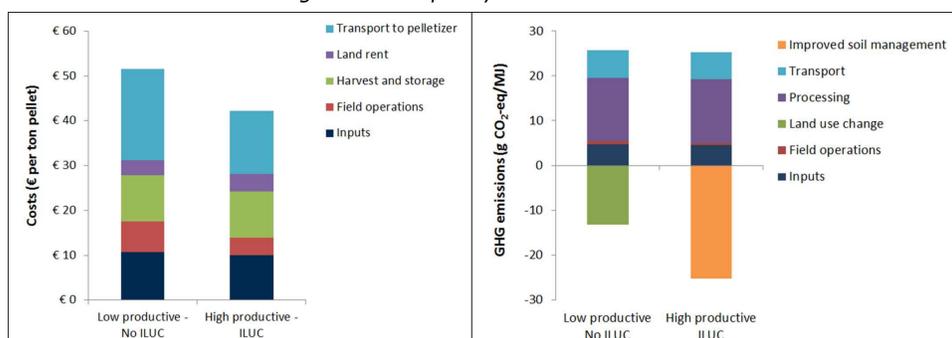
Sustainability/Impacts: Favourable when compared to most biomass crops due to low input requirements and efficient nutrient and water use and due to high soil carbon storage potential.

Outlook: Switchgrass is also one of the crops that may be able to produce reasonable yields at low cost on marginal and lower quality land. The crop can also have a large impact as demand for second generation fuels increases, which require lignocellulosic biomass. This may be one of the ways to source biomass without competing with food crops for land. Thus avoiding the so-called indirect land use change effect (iLUC).

Figure 1. Switchgrass varieties vary in growth habit from thin and leafy (upland) to taller and upright (lowland).



Figure 2. Production cost of switchgrass projected in Ukraine on good and low quality soils and GHG balance on high and low quality soils modelled for Ukraine.



Comparing switchgrass to *Miscanthus x giganteus*

A comparison between switchgrass and *Miscanthus x giganteus* supports the view that each of the perennial biomass crops switchgrass and Miscanthus may have a different niche. Switchgrass has lower yield potential than Miscanthus but is very cheap to establish. This suggests that switchgrass may have an advantage on low quality soils where productivity potential is limited and where the high establishment cost of Miscanthus cannot be recovered.

Also under high capital cost conditions (high interest rates) and when the price of biomass is low and when the cost of land is low switchgrass may have an advantage.

Table 1. Comparison of *Miscanthus x giganteus* to switchgrass

Attribute	Miscanthus	Switchgrass
Native Range	South East Asia, Japan	North America
Photosynthesis system	C ₄	C ₄
Height	Up to 4 m	Up to 2,5 m
Rotation time	15 years	15 years
Propagation method	Rhizomes	Seed
Harvest time	Fall to early spring	Fall to early spring
Energy output/input*	12 to 66	8 to 54
Yields (DM)*	10 – 40	6 – 25
Biomass quality for thermal conversion	Lower	Higher
Water use	Rel. low	Rel. low
Erosion control	Rel. good	Very good
Establishment cost	€300/ha	€3000/ha
Productivity	Higher	Lower
Water use efficiency	High	High
Nutrient efficiency	Very high	High
Need for inputs	Low	Low
High yield under marginal conditions	Yes	Yes
Fits into rotations	No	No
Need for special machinery	Yes	No
Years to break even	Longer	Shorter

Figure 3. Miscanthus and switchgrass grown side by side in summer and winter (just before harvest) showing the difference in length and growth habit.



References and Acknowledgements

- The information has been partially generated within the Pellets for Power project funded by NL Agency under the Sustainable Biomass Import Programme” <http://www.agentschapnl.nl/en/programmas-regelingen/sustainable-biomass-import>
- Elbersen, Wolter, Ronald Poppens and Rob Bakker. 2013. Switchgrass (*Panicum virgatum* L.). A perennial biomass grass for efficient production of feedstock for the biobased economy. A report for the Netherlands Programmes Sustainable Biomass of NL Agency.