



A Management Guide for Planting and Production of switchgrass as a biomass crop in Europe

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Rome 12 May, 2004



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What is switchgrass?

- Perennial C₄ grass
- Yields 6 to 25 tonnes/ha
- Seed propagated
- Deep roots (2m)
- Low input
- 15 year cycle
- Leafier and smaller than *Miscanthus*

- Applications:
- Fibre/pulp
- Power/heat
- Ethanol
- Feed





Critical elements

- Variety choice
- Establishment
- Fertilisation
- Harvest management

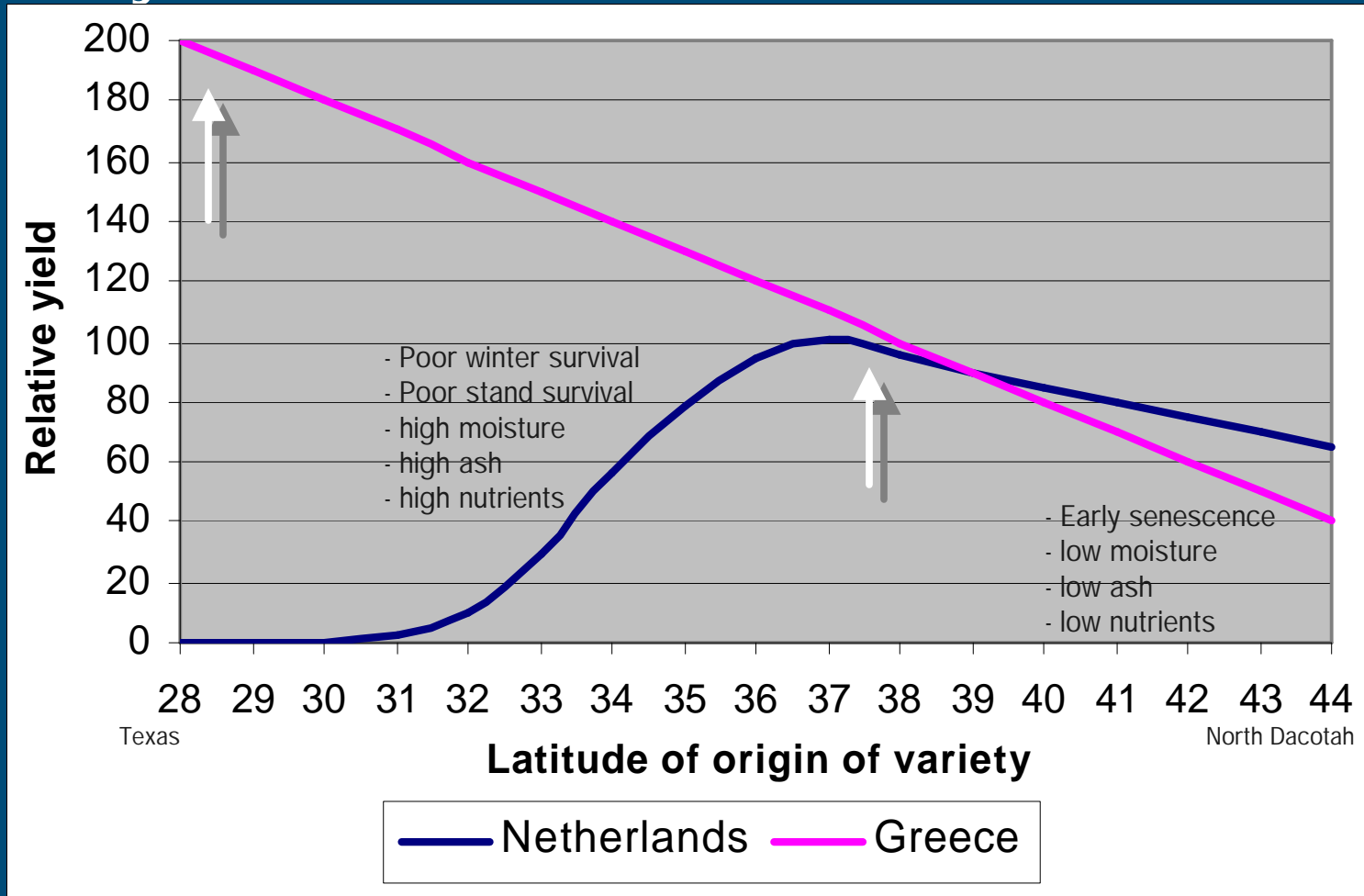


Variety choice

Variety	Ecotype	Ploidy level	Origin	Seed weight†
Alamo	lowland	Tetraploid	South Texas 28°	94
Blackwell	upland	Octoploid	Northern Oklahoma 37°	142
Caddo	upland	Octoploid	South Great plains 35°	159
Carthage = NJ-50	?	?	North Carolina 35°	148
Cave-in-Rock	Intermediate?	Octoploid	Southern Illinois 38°	166
Dacotah	upland	Tetraploid?	North Dakota 46°	148
Forestburg	upland	Tetraploid?	South Dakota 44°	146
Kanlow	lowland	Tetraploid	Central Oklahoma 35°	85
Nebraska 28	upland	?	Northern Nebraska 42°	162
Pangburn	lowland	Tetraploid	Arkansas 34°	96
Pathfinder	upland	Octoploid	Nebraska / Kansas 40°	187
REAP 921	upland	Tetraploid	Southern Nebraska 41°	90
Shelter = NY4006	mixed?	Octoploid?	West Virginia 40°	179
Summer	upland	Tetraploid	South Nebraska 41°	114
Sunburst	upland	?	South Dakota 44°	198
Trailblazer	upland	Octoploid	Nebraska 40°	185



Variety choice





Variety Choice

- Switchgrass varieties grown too far north will have:
 - Later or no flowering and maturity
 - High yields in first year
 - Lower yield in later years
 - Decreased winter survival
 - High moisture content at harvest
 - Higher nutrient contents at harvest
 - Decreased stand survival in long term?
- Switchgrass varieties grown too far south will have:
 - Early flowering and maturity
 - Lower yields
 - Good winter survival
 - Low moisture content at harvest
 - Good stand maintenance





Establishment

- Follow the rules and it will work!
 - Establishment takes > 1 year
 - Site selection
 - Site preparation
 - Variety choice
 - Germination test
 - Time of planting
 - Don't worry too much about weeds



Establishment: Site selection

- Best is deep soil, good water holding capacity and drainage, but;
- Well adapted to adverse condition:
 - Shallow soils, stony soils
 - Occasionally waterlogged soils
 - Low soil fertility and
 - (Very) low pH



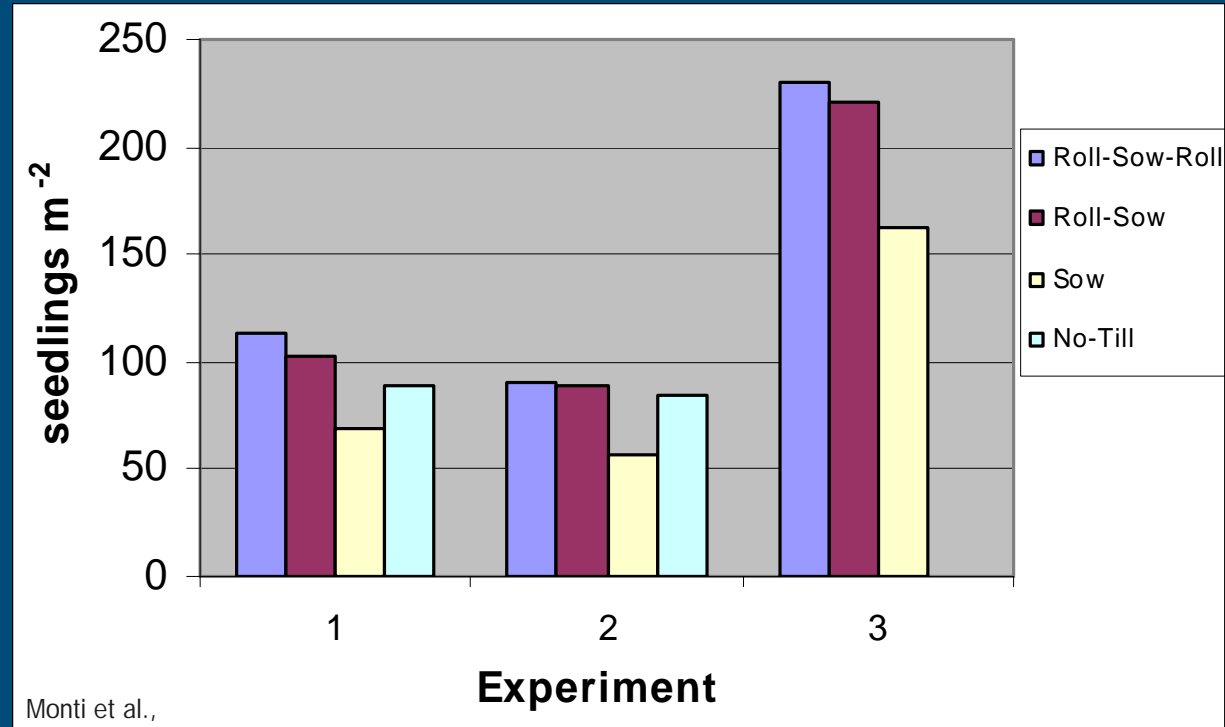
Establishment: Site preparation

Weed free - false sowing?

No fertilisation (will promote weed growth)

Compact soil before and after seed drilling!

No-till establishment works!





Seed rate and row spacing

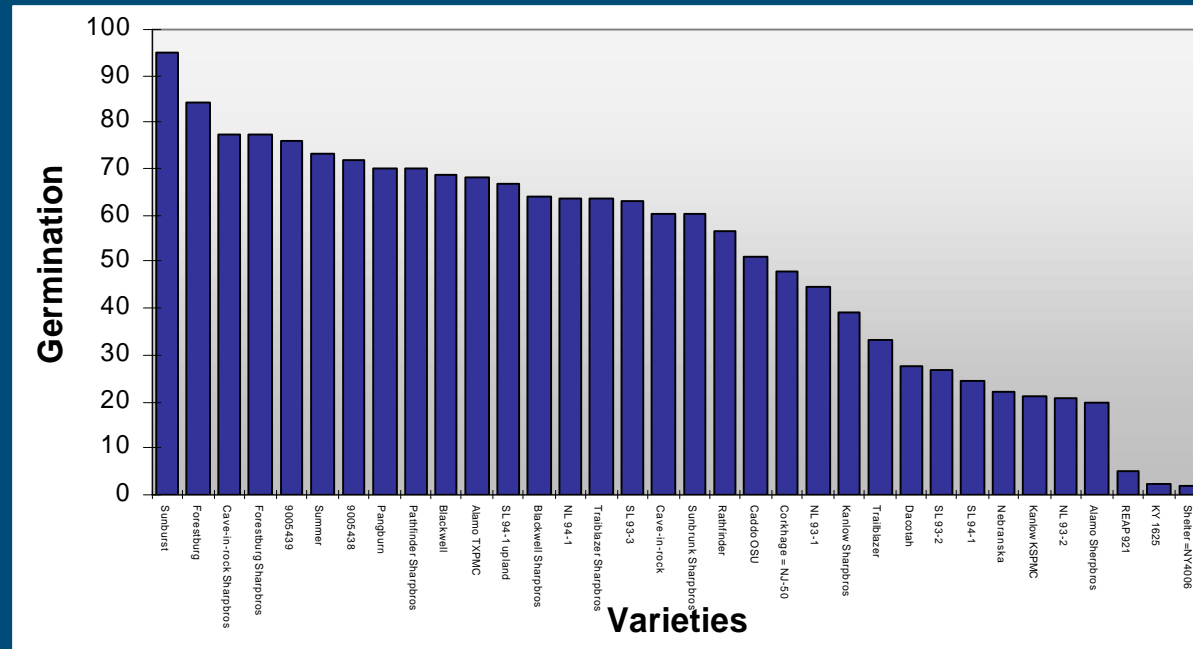
Perform germination test!

Seed rate 10 to 20 kg
seed/ha

200 - 400 PLS in North

100 - 200 PLS in South

Goal is a minimum of 10 to
30 plants /m²





Establishment: Planting time and equipment

- Plant at same time as Maize (>10 °C)
- Too early --> weed problem
- Too late --> moisture problems

- Planting can be done with normal equipment
- Row spacing:
 - >15 in north
 - 30 - 50 in south
- Seeding depth 10mm





Weed control and pests and diseases

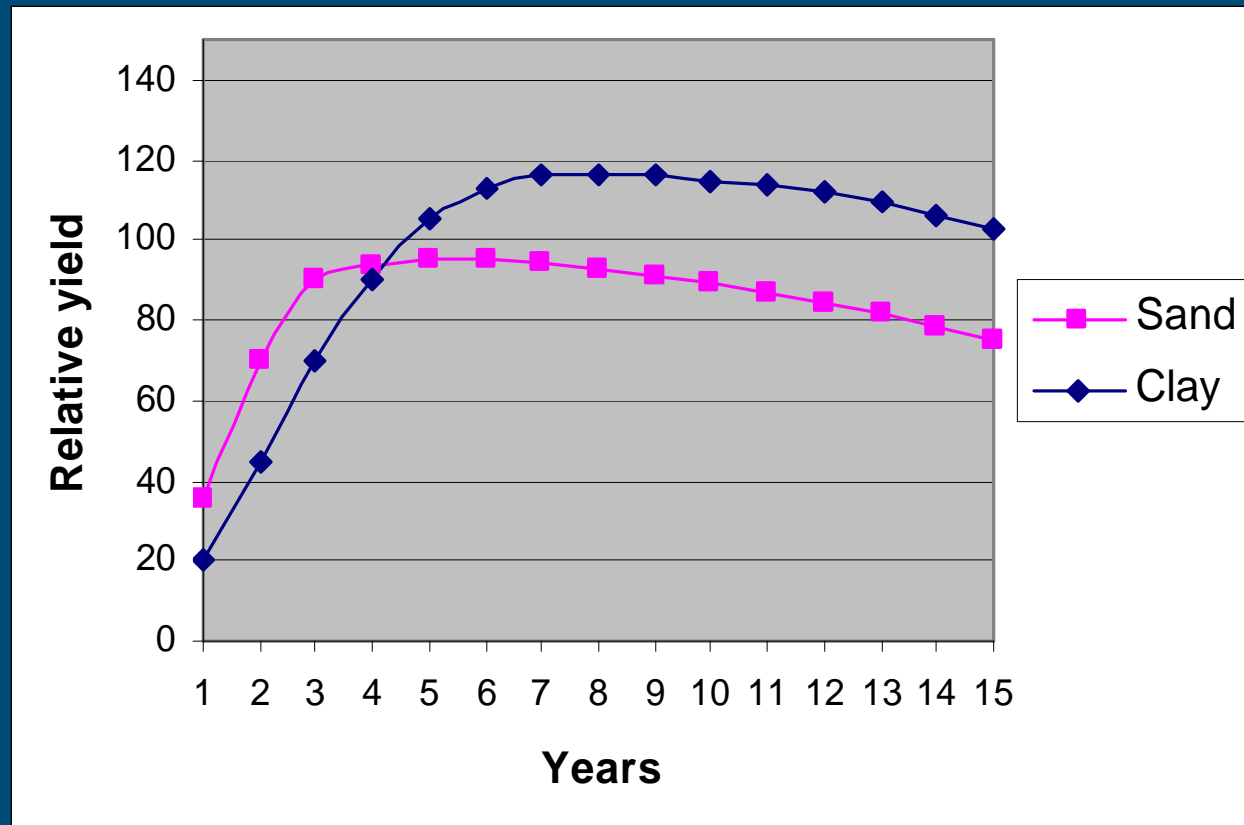
- Weeds can (will) be problem in first year
 - Goal is to have sufficient seedling survival!
 - Seedbed preparation -
 - Chemical control possible generally not necessary
 - Mowing weeds is efficient ----->
- Pests and diseases
 - Less of a problem
 - Damping off
 - Some rusts





Fertilisation: Management and yield development

- Fertilisation
 - Not in first year
 - Following years:
 - low P and K
 - Nitrogen:
 - 0-50 kg in North
 - 50-100 in South
- Yield development takes 3 to 5 years





Main problems:

- Lodging
- Weeds in first year



Harvest and storage

Harvest in winter/spring

At low moisture (<20%)

Estimated cost (without land cost)
vary:

- 24 Euro DW/t in Greece
- 62 Euro DW/t in the Netherlands

Compares favorably to *Miscanthus*
since the cost and risk of
establishment is lower





Quality and harvest time

Harvest time	N	P	K
Fall	0,46	0,12	0,95
Winter/ Spring	0,33	0,04	0,06

Ash content	Clay	Sand
Switchgrass	5,5	2,1
Miscanthus	5,9	1,0



Where and how to grow switchgrass?

- Make use of specific attributes
 - Low establishment costs (seed)
 - Low fertilisation
 - Low pesticide use
 - Low water use
 - Erosion control
 - Adapted to low pH soils
 - C-storage
 - Wildlife shelter
 - Height, max 2 m



Further information:

- www.switchgrass.nl