ENHANCEMENT OF GLOBAL SUSTAINABILITY OF BIOETHANOL PRODUCTION FROM SORGHUM

R. Poletti [1], L. Poletti [1], A. Poletti [2], G. Berna [3]

1 **Sereco Biotest snc**, Studi e Ricerche Ambientali – Perugia-Italy
2 **CHI.FI.E.M.A. Laboratory –** Department of Chemistry, University of Perugia**,** Italy
3 **Maridiana srl**, Fraz. Niccone 173, Umbertide, Perugia, Italy

SORGHUM SOIL INTENSIVE USE

To mantain productivity level 17-20 t/ha y d.m.
8 t/ha y sugar

150-200 kg N/ha
100 kg P_2O_5 /ha
100 kg K_2O /ha
part sowing time
part as covering
For soil at medium sub-alkaline reaction

BIOETHANOL PRODUCER PROBLEMS

Traditional

STRATEGY OF N and P REPLACEMENT

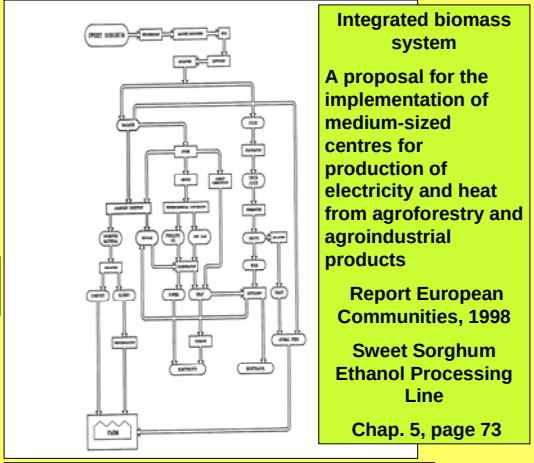
1

X **NO recommended**

MONOSUCCESSION requires in addition yearly 30-40 kg N/ha
[Emilia Romagna (Italy)]
[Cordoba (Argentina)]

2

INTERCROPPING CULTIVATION like
Glycine max L.
Vicia faba var. minor
Vicia sativa,
Trifolium repens
Trifolium
Nitrogen residues 40-70 Kg/Ha
See also *P.K. Ghosh et al, Bioresource Technology, 95 (2004) 85-93*



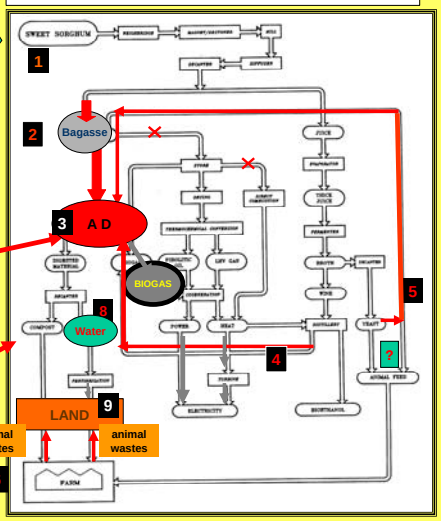
Integrated biomass system

A proposal for the implementation of medium-sized centres for production of electricity and heat from agroforestry and agroindustrial products

Report European Communities, 1998

Sweet Sorghum Ethanol Processing Line

Chap. 5, page 73



Main Material Flows

1 – 3	Sweet sorghum and other agri wastes
2 – 3	Bagasse (50% to direct combustion)
4 – 3	Stillage
5 – 3	Yeast
6 – 3	Animal wastes to AD
6 – 7	Animal wastes to composting
7 – 8	Compost to land
8 – 9	Fertirrigation

BY PRODUCTS

Other biomasses from territory

INTEGRATION OF ANAEROBIC DIGESTION AND COMPOSTING

Relevant differences between composting and biogasification (excluded CO_2 balance)		
	Biogasification	**Composting**
Plant cost	**++++**	**+**
CHP electricity produced	**++++++ (value)**	**0**
CHP heat produced	**+++++ (value)**	**0**
Wastewater	**Water, Organic C, N, P, K**	**0**
Sludges	**Organic C, N, P, K**	**0**
Odours control	**easy**	**May be a problem**
Substrate degradation	**65-70%**	**60%**
Humic matter content	**+**	**++++**
Energy Consumption (electrical) (1)	**50 kWh/t of ton to AD** (old standard design criteria)	30 kWh/ton of input to biol pre-treatment
Energy production(2)	100-250 kWh/t	-70 - -90 kWh/t
CO_2 emission (1)	440 kg / t	320 kg / t (566 kg / t converted to the 500 kg dry matter/ t)
CH_4 emission (1)	negligible	2 kg / t converted to the 500 kg dry matter/ t)

Data from ref. ***(1) IEA Bioenergy AD Activity (2004) Reccomended citation :Aumonier S. (1977), Life Cycle Assessement of Anaerobic Dig. A Literature Review RDA/SR-97002 Washington, DC***
(2) Cecchi, L. Innocenti Conference Soil and Biowastes in Southern Europe Rome 18-19 January 2001)

DECISION INSTRUMENTS

LCA Life Cycle Assessment
MFA Material Flow Anaysis

Energy, Exergy, Emergy optimization

PROJECT