



**“Prodotti Energetici dalle Bioraffinerie: Nuove Opportunità per
l’Industria Saccarifera Italiana”**

Verona, 7 febbraio 2008

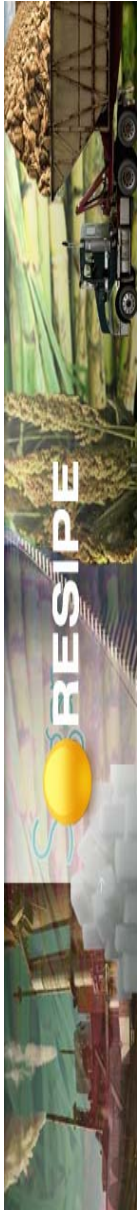
Centrocongressi Arena – Sala Puccini

« *Bioenergy World* » - 108° Fieragricola

Sweet Sorghum
Agronomic aspects

Maurizio Cocchi

ETA Renewable Energies



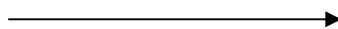
SORGO ZUCCHERINO

Scientific Name: *Sorghum bicolor* L. Moench

Family: Graminae

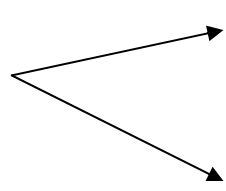
Origin: Northern and East Africa (Ethiopia)

Photosynthesis C4



High growth rate

Very efficient root system



Low water requirements

Annual crop cycle

Drought resistant

Traditional use: forage, concentrated syrup (USA)

SORGO ZUCCHERINO – MORFOLOGIA

Lateral shoots

Stems up to 5 m height – pithfilled stems



Inflorescence: panicule

(1.000-5.000 seeds)

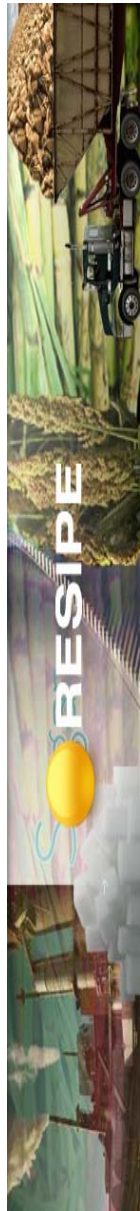
Self-pollinating

Leaf area smaller
than mais



Strong root system

Tillering sprouts



SORGO ZUCCHERINO – ESIGENZE PEDOCLIMATICHE

Minimum tolerated temperature: 7-10°C

Optimal growth temperature: 27-30°C

Water requirements: 500-600 mm

Soil requirements: tolerant to salty and alkali soils (pH 5.0-8.5),

Nutritional requirements: high mineral absorption efficiency

Fertilization: 120-150 Kg/ha N; 60-70 Kg/ha P₂O₅; 60-120 K₂O



VARIETA' E MIGLIORAMENTO GENETICO

The first experiences of genetic improvement date back to 1850 in USA (Cv. Amber from China)

Hybridization trials at the beginning of XX century

Several varieties developed between 1920 and 1950

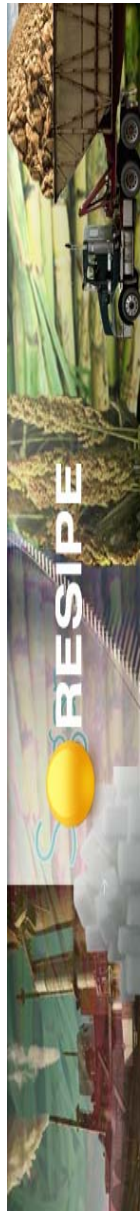
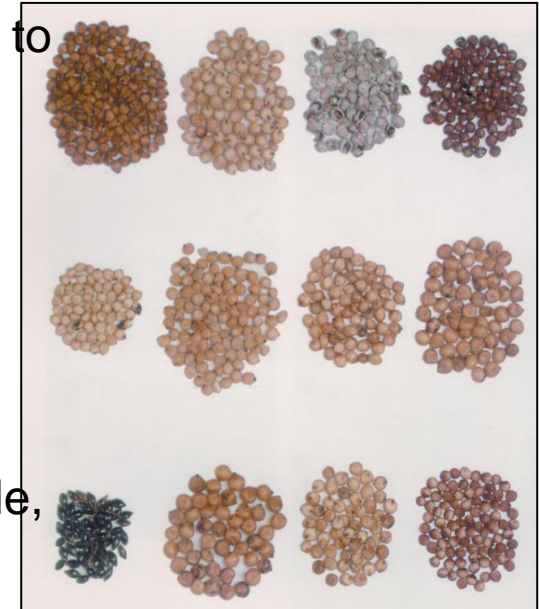
In Italy several varieties tested in 2000-2001 (ECHI-T project)

9 genotypes selected as very promising: Keller, Mn, Dale, Wray, Theis, M81-E, AT623XRoma, Chinese1

In Germany: evaluations, trials and genetic improvement since early '90, with good results at 52°

Ongoing research programs in USA, INDIA, BRASILE, CINA

Some selected traits: adaptation to temperate climates, fermentable sugar content, resistance to logging



CENNI DI TECNICA COLTURALE

Seed bed preparation: medium depth tillage and harrowing, need a soft seed bed

sowing: centre-north Italy in the second half of April, sowing at 2 cm depth

Distance: 70 cm between rows, 15-20cm on row (6kg seeds/ha)

Fertilization: 120-150 Kg/ha N; 60-70 Kg/ha P₂O₅; 60-120 K₂O

Crop rotation: maize should not be planted before or after sorghum

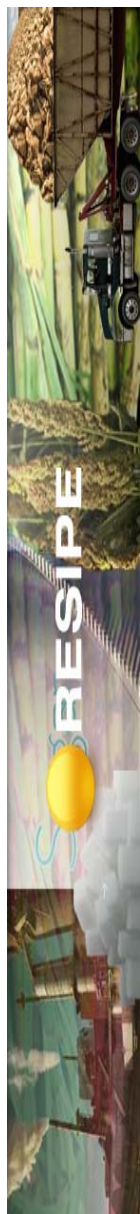
Cycle length: 90-140 days depending on variety

Weed management: pre-emergence treatment may be necessary,

Irrigazione: does not require irrigation with annual rainfall higher than 700 mm, although an irrigation at flowering is often highly beneficial

Harvesting: echanized – **requires customized machinery**

Possible pests and diseases: antrachnose, rust, mosaic virus, aphids, bugs.





PRODUTTIVITA'

Average productivity

70-90 t/ha fresh biomass

5-7 t/ha grains

6-7 t/ha sugar

Distribuzione del peso

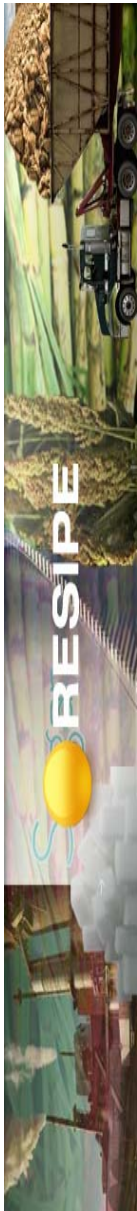
Stalk: up to 75%

Leaves: 10-15%

Grains: 7%

Roots: 10%

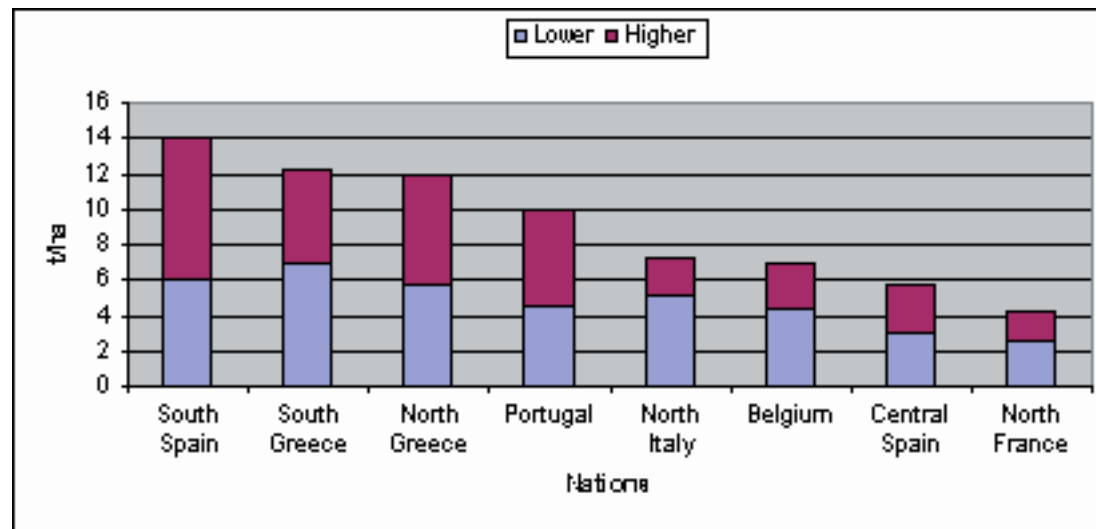
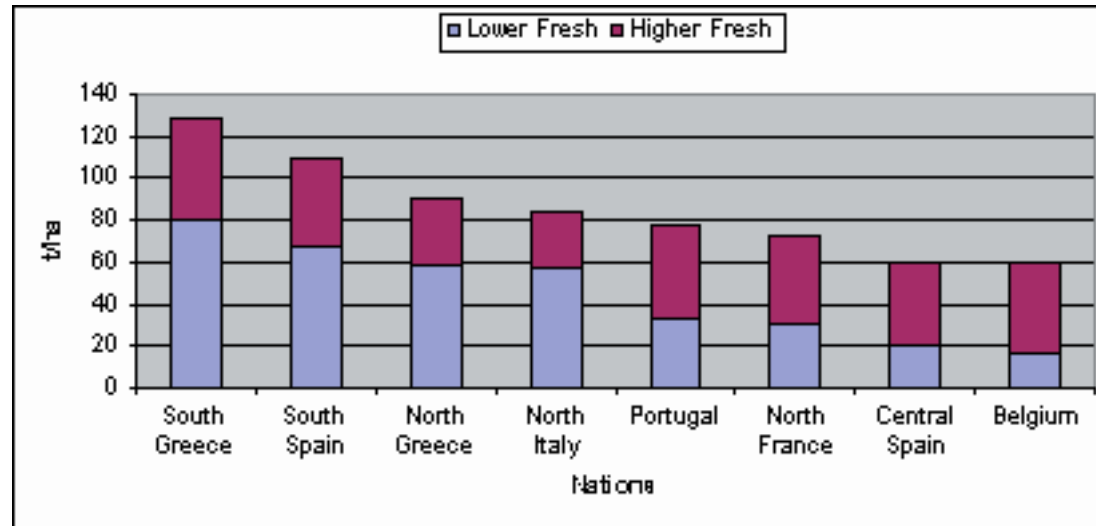
Ethanol yield (sugar + starch): 5.500 up to 6.000 l/ha



Fresh biomass

Sugar

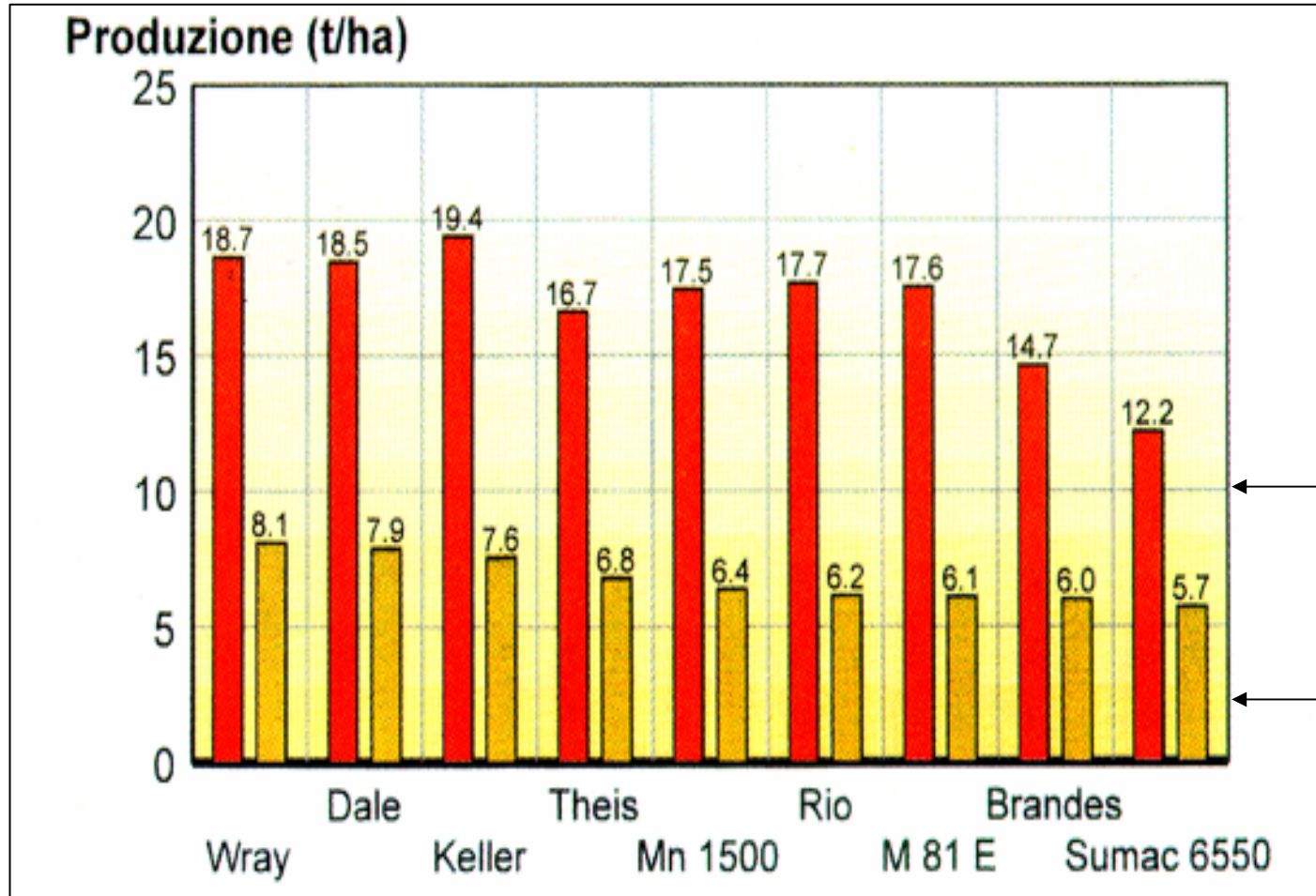
PRODUCTIVITY



Fonte: Eubia



PRODUCTIVITY – SOME CULTIVARS



Dry matter

Sugar

Fonte: Biotec

SUGAR

Contained in the stalks, can be extracted by milling

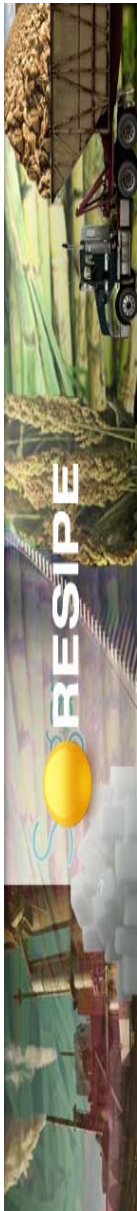
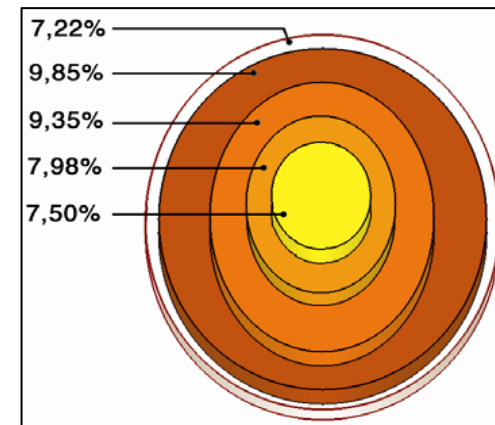
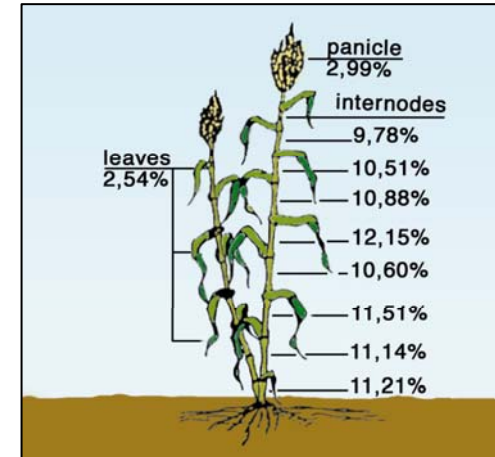
Over 14 different sugars - the main ones:

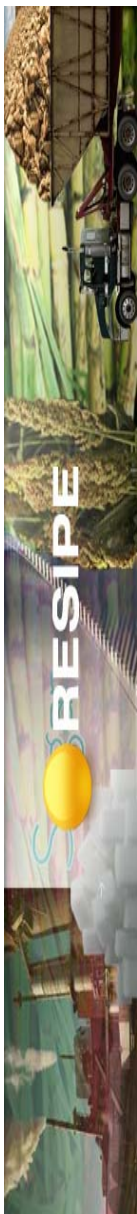
Saccharose

Glucose

Fructose

Homogeneous distribution of sugars
in the stalks





Thank you for your attention



Contatti per ulteriori informazioni:

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