RESEARCH REGARDING THE FERTILIZATION INFLUENCE UPON BIOMASS PRODUCTION IN SORGHUM
(Sorghum bicolor L. MOENCH)

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Energy and Environment Knowledge week Toledo, Spain,
TIMIȘOARA
THE 12th NOVEMBER 1884
THE FIRST TOWN OF EUROPE WITH STREETS ILLUMINATED BY ELECTRIC LIGHT

Energy and Environment Knowledge week Toledo, Spain,
Energy and Environment Knowledge week Toledo, Spain,
Energy and Environment Knowledge week Toledo, Spain,
Temperature prediction

Precipitation prediction

Energy and Environment Knowledge week Toledo, Spain,
Romanian soil drought map

source: http://www.incont.ro/foto/harta-secetei-in-romania
Energy and Environment Knowledge Week Toledo, Spain,
Mean of precipitations (mm)

Mean of temperatures (°C)

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Why sorghum?
Sorghum bicolor L. Moench

- is well adapted to adverse climatic conditions which at this time is one of the growing concerns in agronomic projections,

- high efficient photosynthetic crop that reached a worldwide production of 56 million tons of grain in 2009 (FAOSTAT 2011), just behind maize, wheat, rice and barley,

- is a C4 plant, highly tolerant to some biotic abiotic stress factors (insects, drought, salinity and soil alkalinity)

- have one of the best rates of carbon assimilation (50 g/m^2/day) which in turn allows a fast growth and a better rate of net CO2 use (Prassad et al 2007)

- requires one third of the water with respect to sugar cane and 80-90% compared to maize (Almodares & Hadi, 2009, Wu et al., 2010)

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Types of sorghum

- Sorghum can be classified in 3 broad groups:
  - Grain – used mainly for food, feed and starch (sometimes for fuel ethanol?–)
  - Sweet – juice rich in fermentable sugars (sucrose, glucose and fructose)
  - Forage (high biomass) – ethanol production

Energy and Environment Knowledge week Toledo, Spain,
A. Increase in photosynthesis vs. increase in light intensity

- **C₃ plant**
- **C₄ plant**

B. Quantum yield of photosynthesis vs. increase in temperature

- **C₃ plant**
- **C₄ plant**
THE RESEARCH OBJECTIVES, MATERIALS AND METHOD

1 – Jumbo
2 – Sugargraze
3 – Sugargraze II
4 – F135ST
cultivar. Jumbo (*Sorghum bicolor* x *sudanense*)

Sorghum bicolor, var. Sugargraze

Sorghum bicolor, var. Sugargraze II

Sorghum bicolor, var. F135ST
- Plant development - phenological BBCH code for cereals

DETERMINATIONS AT:

- 14 - four leaves, unfolded
- 37 - flag leaf just visible, still rolled
- 67 - full flowering, 70% of anthers mature
- 89 - full ripe, grain hard

TYPES OF ANALYSIS:
- plant height (cm), leaf area (cm²/plant); plant weight (g); biomass production (tones/ha), dry biomass (tones/ha), seeds production (kg/ha), soluble sugars content in stalks (%).

METHODS

- Plant height – measured. Leaf area - leaf area meter Li 3000C portable, plant weight-gravimetric, biomass production - by harvesting, dry matter - thermobalance (KERN & Sohn GmbH, MLB 50-3N), soluble sugars – spectrophotometric method (glucose is oxidised by the glucooxydisis in contact with gluconic acid and hydrogen peroxide. It the presence of the enzyme, it reacts with the phenol and 4-aminoantipyrine forming a pink iminochinoic colorant with a maximum of absorption at 510 nm. The pink intensity of the solution is in direct relation to the glucose content)
The experimental variants in the case of these determinations were as follows:

- \( V_0 \) – natural reserve;
- \( V_1 \) – \( N_{150}P_{62.4}K_{62.4} \) a.c.kg/ha;
- \( V_2 \) – \( N_{150}P_{62.4}K\) a.c.kg/ha.

<table>
<thead>
<tr>
<th>Variants</th>
<th>pH</th>
<th>Total N %</th>
<th>Humus %</th>
<th>P ppm</th>
<th>K ppm</th>
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</thead>
<tbody>
<tr>
<td>( V_1 )</td>
<td>6.03</td>
<td>5.17</td>
<td>5.35</td>
<td>0.15</td>
<td>0.2</td>
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<tr>
<td>( V_2 )</td>
<td>6.03</td>
<td>5.54</td>
<td>6.24</td>
<td>0.15</td>
<td>0.24</td>
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S. st.- sowing; F. st.- flowering (67 BBCH); R. st.- ripening (89 BBCH)
Results regarding the genotype effect, fertilisation and the determination moment on morphology, physiology and productivity of sorghum

1. Results regarding the plants growth dynamics

Sorghum plant height for different genotypes and fertilization variants

Height of sorghum plants for different genotypes and determinations
Leaf area of sorghum plant for different genotypes and fertilization variants

Sorghum leaf area – different genotypes and phenophases

Sorghum plant weight for different genotypes and fertilization variants

Sorghum plant weight – different genotypes and phenophases
Biomass yield in sorghum for different genotypes and fertilization variants

Sorghum biomass production – different genotypes and phenophases
Dry weight yield in sorghum for different genotypes and determinations
Results regarding seeds production

<table>
<thead>
<tr>
<th>Fertilization variant</th>
<th>Mean (kg/ha)</th>
<th>Relative values (%)</th>
<th>Differences/Signification</th>
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<tr>
<td>V₁ – V₀</td>
<td>3903</td>
<td>3156</td>
<td>123,67</td>
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<tr>
<td>V₂ – V₀</td>
<td>4185</td>
<td>3156</td>
<td>132,60</td>
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<tr>
<td>V₂ – V₁</td>
<td>4185</td>
<td>3903</td>
<td>107,23</td>
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The effect of fertilization upon seeds production

The effect of genotype and fertilization upon seeds production

<table>
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<th>Experimental variant</th>
<th>Genotype</th>
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<td>V₀</td>
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<tr>
<td></td>
<td>x3406b</td>
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<tr>
<td></td>
<td>x2907a</td>
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<td>V₁</td>
<td>F135ST</td>
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<td></td>
<td>x4365ab</td>
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<td></td>
<td>x3442a</td>
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<td>V₂</td>
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<td>x5049a</td>
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<td>y3321a</td>
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Results regarding the content of sugars

- Solublesugars
- Glucose
- Sucrose

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<th>Vo</th>
<th>V1</th>
<th>V2</th>
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<tbody>
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<td>F135ST</td>
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Concerning the genotype, the data obtained show the very good behaviour of the studied genotypes, the efficient rates of the Romanian hybrid F135ST superior to all the other genotypes, the efficiency registered being statistically ensured as significant.

In the case of biomass production the experimental results obtained confirm the fact that fertilisation determines significantly the growth of production unlike the unfertilised instance.

The Jumbo genotype registered a development of the total glucide content in the fertilised variants as compared to the witness variant. It was also noticed that the fertilised variant $N_{150}P_{62.4}K_{62.4}$ s.a.kg/ha registered the smallest content of saccharose and the largest glucose content (the biggest proportion of glucose/saccharose) of all the analysed samples within all the variants and genotypes under scrutiny.
Thank you!