The ear leaf productive coefficient for some maize hybrids (Zea mays L.) under agroecological conditions of Kosovo

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Abstract
The main objective of our study was to determine genetic potential and leave surfaces (LS) in seven maize hybrids of different origin and maturity: BC288BSR-Croatia (FAO-300), Jumbo-Austria (FAO-400), BC418BSR-Croatia (FAO-400), BC394SR-Croatia (FAO-400), Colombo-Austria (FAO-400), and Pregia-Austria (FAO-600). The field experiment was with combination formula; G-7 x Gr-3 x I-2 xR-3 xY-2 x L1=252 combination. The research was realized during year 2005 (Y1) and 2006(Y2). Field trial was set as randomized complete block design. The total active surfaces for experimental plots was 588 m², with density plant 47000 per ha. Minimal leaf surfaces (MLS) for two years have been realised at hybrid BC288BSR (Xy₁=579.2 and Xy₂=476.3 cm²), while with MLS for two years had hybrid Pregia (Xy₁=739.8 and Xy₂=795.7 cm²). Total experimental value µ for LS for two years were 627.9 cm², compared with genotype average value for two years, distinguished was +137.8 and -102.3 cm² or 0.21 and 0.16%, these differences are higher significance for level of probability 0.01. For Productivity Leaf Potential higher values had realised Pregia (208.61 g/kernel/plant), while with lower value was BC288BSR (163.24 g/kernel/plant). Higher value for Leaf Productive Capacity had realised genotype Colombo with value 3.77cm²/g, while with lower was Jumbo-48 (3.13 cm²/g).

Keywords: maize genotypes, leaf surfaces, Productivity leaf potential, Leave productive Capacity

Introduction
Development of new maize hybrids has become from genotype differences and that is one part of the problem, while in other side importance in practice have reaction of development genotype compared to ecological factors (Fetahu, 2001). The higher productivity showed genetic hybrid potentials, climate of environment, but also and cumulative effects of hybrid power (heterosis) to increase productivity in proportion to other factors that are with participation from 42-89% (Russel, 1986). The use of hybrid seed at Kosovo had influenced in increased of yield for 6.5% per ha, in last decade , while increased of yield for different decades was 9% ,which is always compared with local population, while increased of genetic ability for hybrid was 12.9%, (Fetahu, 1998, 2001). The main objective of this study was to research and analyse some morphological and physiological parameters with experimental methods including LS, PLP, and LPC in some maize hybrid with different maturity and different origin influenced from a biotic factors.

Materials and methods
Maize genotypes was of different maturity group: FAO-300, 400 and 600 , and different origin : Institution –BC(Croatia) with hybrid : BC288, Jumbo-48, BC418, BC408 , BC394
and Pioneer (Austria) with hybrids Colombo and Pregia. Investigation are realised during years Y1(2005) and Y2 (2006) at a locality of Prishtina region. The experimental plots were designed which is involved randomised block (RCBD) with three replications G-7x G-3 x I-2 x Y-2 x L-1 x R-3 = 252 combination. The active experimental plots were 28 m², with four rows (r=4) and long 10m. The plant distance was 70 cm apart with 30 cm plant to plant distance or 47000 plant per ha, cultivated without irrigation. Resources of data base for irrigations and temperatures were from Hydro-meteorological Institute of Kosovo and are showed at Walter Climate diagram (Figure 1). Productive Leave Capacity (PLC) is determined through practice indicators as relation between Leave surfaces (LS) and productive potential grain per plant with 14% moisture. Leaf Surfaces (LS) was measured dimensions of the leaf blade growing from the some node as the ear. LS was determined according to the formula of Montgomery (1911) according to the date of Aliu et al. (2008) as following: \( A = L \times W \times 0.75 \), where \( L \) represent leaf length, \( W \) is leaf width and 0.75 is the factor used for determination of LA in maize. Determination of primary interaction and statistically analyses were calculated by linear equation of Mather and Jinks (1977, 1992) as following: \( G \times Y; X = \mu + g + r + l + v + gl + e \),

Where:
- \( X \) is the phenotypic characteristics,
- \( \mu + g \) is the genetic effects,
- \( l + v \) effect of ecological factors
- \( gl \) is the interaction between genotype/environment and \( e \) is the non definite factors

Results and discussion
Precipitation was 613.3 mm, while its distribution across the seasons was as followed: winter 22%, spring 31.07%, summer 25.09% and autumn 21.82%. From the total rainfall, 53.07% was present during winter and spring period, in this time when there is no maize vegetation. Temperatures have regular trend of decrease and increase according to equinox and year season in the cyclic way. The accumulated temperature above zero degree (°C) for the year investigations was \( Y1=10.08^\circ C \), with annual values of 3679° C, while temperatures were above \(+10^\circ C \). During vegetation it was 2985° C, while in the second year (Y2) 10.45° C, with annual sum of 3814° C and for vegetation period 3060° C. Average temperature for investigated year were 10.27° C with annual vegetation 3022° C. These values are presented by Walter Climate diagram, presented in Figure 1.

![Figure 1. Climate-diagram of rainfall and temperatures for locality Prishtina](image-url)

Leaf at the biological cycle in growth of plant maize, is nonreplicable especially at process of photosynthesis, creation of organic material, productivity of grain and green biomass.
LS of maize oscillate from 0.3-1.2m²/plant, while at forms that have secondary stalks LS can obtained 1.3 m² (Jevtić, 1977). Average values for LS in our research for genotypes were with different values and higher significant differences between hybrids. Average experimental value for LS for all treatments were μ = 629.92 cm²/plant, while for different years was Y1 = 666.5 and 594.3 cm²/plant, with differences between as 71.2 cm² or 11.30%. The study by Aliu., et al (2008) carried out locally in 45 hybrid combination for LS in agro ecological conditions of Kosovo presented different results for different genotypes with experimental average value μ = 678.8 cm², with average maximal and minimal value of 558.9-788.6 cm². The assimilative leave surfaces (ALS) was in accordance with FAO groups: FAO-300 = 543.96, FAO-400 = 610.47 and FAO-600 = 745.07 cm². Total variability for ALS at different FAO groups were: FAO (300-400) = 66.51 or 10.56%, FAO (300-600) = 201.11 or 31.92% and FAO (400-600) = 134.6 cm² or 21% compared with value μ, these results are presented in Table 1.

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Y1</th>
<th>Y2</th>
<th>( \bar{X} )</th>
<th>Y1</th>
<th>Y2</th>
<th>( \bar{X} )</th>
<th>Y1</th>
<th>Y2</th>
<th>( \bar{X} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC-288</td>
<td>579.20</td>
<td>476.30</td>
<td>527.75</td>
<td>178.22</td>
<td>148.25</td>
<td>163.24</td>
<td>3.24</td>
<td>3.21</td>
<td>3.23</td>
</tr>
<tr>
<td>BC-394</td>
<td>604.37</td>
<td>562.50</td>
<td>583.43</td>
<td>182.21</td>
<td>154.41</td>
<td>168.31</td>
<td>3.31</td>
<td>3.64</td>
<td>3.48</td>
</tr>
<tr>
<td>BC-408</td>
<td>689.00</td>
<td>566.30</td>
<td>627.65</td>
<td>199.65</td>
<td>185.22</td>
<td>192.44</td>
<td>3.45</td>
<td>3.05</td>
<td>3.25</td>
</tr>
<tr>
<td>BC-418</td>
<td>674.47</td>
<td>566.20</td>
<td>620.33</td>
<td>196.29</td>
<td>171.57</td>
<td>183.93</td>
<td>3.43</td>
<td>3.30</td>
<td>3.37</td>
</tr>
<tr>
<td>Jumbo-4</td>
<td>643.83</td>
<td>476.50</td>
<td>560.17</td>
<td>191.25</td>
<td>164.22</td>
<td>177.73</td>
<td>3.36</td>
<td>2.90</td>
<td>3.13</td>
</tr>
<tr>
<td>Pregia</td>
<td>739.77</td>
<td>795.73</td>
<td>767.75</td>
<td>211.41</td>
<td>204.69</td>
<td>208.05</td>
<td>3.49</td>
<td>3.88</td>
<td>3.69</td>
</tr>
<tr>
<td>Colombo</td>
<td>727.90</td>
<td>716.87</td>
<td>722.38</td>
<td>208.61</td>
<td>176.68</td>
<td>192.65</td>
<td>3.48</td>
<td>4.05</td>
<td>3.77</td>
</tr>
<tr>
<td>Average</td>
<td>665.50</td>
<td>594.34</td>
<td>( \mu=629.92 )</td>
<td>195.38</td>
<td>172.15</td>
<td>( \mu=183.76 )</td>
<td>3.39</td>
<td>3.43</td>
<td>( \mu=3.41 )</td>
</tr>
</tbody>
</table>

From our investigated maize hybrid for the extreme values were hybrid BC288 from FAO group 300 and Pregia FAO group 600. Their distinguished between Y1 were 160 cm² or 25%, while for the Y2 was 319.43 cm² or 50%. The variability of LS in Pregia was 55.96 cm² or ±3%, while in BC288 was 102.9 cm² or ±9%, (Figure 2).

**Table 1. Leaf surface, productivity potential and leaf coefficient of photosynthesis in maize**

![Figure 2. Differences for LS and LPP](image-url)
Based on the ratio for different FAO groups and with different hybrid vegetation, LS increased from 60 to 70 cm²/plant or exactly 67.03 cm²/plant, and was with higher significance for level of probability 0.01, between genotypes, maturity groups, also for the factor year distinguished were significant. Maize genotypes in our research result with different Leaf Productivity Potential (LPP) between maize hybrids were experimental average values was 183.76 g/grain/plant. From results, it’s noticed that genotypes BC288 with value 163.24 g/grain/plant, have smaller assimilated potential, while higher potential had Pregia with average value 208.61 g/grain/plant. Pregia in first year for average LS realised maximal productivity of grain from 211.41, while at the second year had 204.69 g/plant, and distinctions for these years was only 6.72 g/plant or 3%. Hybrid BC288 for the same period realised minimal productivity with values from 178.22 and 148.25g/plant, with differences from 29.97 g/plant or 18%. These genotypes for different years had distinctions from 63.16 g/grain/plant or 34.38% compared with value µ.Hybrid Pregia obtained had higher productivity over + 24.29 g/grain/plant or 13.25% , while hybrid BC288 realised lower productivity from – 20.52 g/grain/plant or 11.6%, with significance for level of probability 0.05=3.17. Average productivity potential value per grain in ratio to LS for plant were at FAO-300 group with 165.77 g, FAO-400 with 184.7 g and FAO-600 with 200.35 g/plant, while distinctions between them were 18.3 g, 34.58 g and 15.65 g/plant. With increasing FAO group, productivity potential grow from10 to 20 g/grain/plant (11.52 g/plant), while other differences are presented at figure 2. Productive potential of leaf realised through photosynthesis for created organic material – grain at maize hybrid with FAO-300,400 and 600 group were in correlation r =0.89. Leaf Productive Coefficient (LPC), from the our results that are presented in table 1 and figure 6, its noticed that gene effects values for photosynthesis coefficients was 3.42 cm², that is necessary for creating of 1 g of organic material of maize grain. The total variability for LPC of all maize hybrid genotypes was 2.90 till 4.05 cm²/g organic material of maize grain. The Jumbo hybrid from BC institute had lower coefficient value from 3.13 cm²/g, while hybrid Colombo had higher LPC, while productivity of organic material was lower. Until BC288 and Pregia hybrid for all others investigated traits was with significant differences, but for LPC had non significant differences, were precisely showed BC288 genotypes. Higher distinctions for LPC are showed among maize hybrids Jumbo-48 and Colombo, were higher photosynthesis productivity had Colombo genotypes, and at second year with differences from 0.64cm²/g or 33%. (See figure 3).

Figure 3. Leaf productive coefficients for seven maize hybrids
Conclusions
The results of this study for quantitative parameters of the maize genotypes in the agro-
ecological conditions of Kosovo at the locality of Prishtina in two years demonstrated that
the LS was in higher correlation with productivity potential, while with LPC it was in opposite
direction. With increasing of duration of vegetation LS and LPP were proportionally
increased, which is effected by genotype that year. The earlier maize genotypes had higher
values for LPC of photosynthesis and for created organic material.

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