THE INFLUENCE OF SOME CHARACTERISTICS OF THE LEAF FLAG ON THE PRODUCTION OF AUTUMN OATS

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Abstract. In recent years, the production and quality of autumn oats have been influenced by the evolution of climate change, characterized by high temperatures and low rainfall. This agricultural year is part of the evolution of the climate through a very warm autumn, extremely poor in rainfall, which led to a difficult preparation of the germination bed for sowing, of poor quality, and the growth of the crop began in winter and ended in next spring. Rainfall and storms in June and July caused a strong fall of plants with major consequences on the quantity and quality of production and delaying the optimal time for harvesting. The ideal production for oats is about 6 tons per hectare, but depending on climatic conditions, technological and quality parameters, this value can fluctuate for autumn oats, an essential requirement is frost and winter hardness, which is also conditioned by other factors. In this study, 15 genotypes from the comparative competition culture for autumn oats were analyzed in the Oat Breeding Laboratory of S.C.D.A. Lovrin to determine the factor with the greatest influence on production in terms of chlorophyll variation, blade thickness and leaf area. Thus, the impact of the flag leaf on the production parameters was determined, by establishing the factor with the most obvious influence. The parameters studied in this experiment were leaf area, leaf blade thickness and chlorophyll content. The flag leaf was used for the indicated determinations. In each of the 15 variants, 40 standard leaves were harvested and analyzed in the laboratory, using the following devices: LI-300 Portable Area Meter (leaf surface) and SPAD 502 Chlorophyllimeter. Following the evolution of production in the analyzed period under the influence of the 3 factors studied, we can conclude the following: when the chlorophyll content increases by 1%, the production increases by 0.26%; when the thickness of the leaf blade increases by 1%, the production decreases on average by 0.13%; when the leaf area increases by 1%, the production decreases on average by 0.001%.

Key words: flag leaf, genotypes, leaf blade thickness, leaf area, chlorophyll and autumn oats.

INTRODUCTION

Oat is a cereal plant that is viewed with interest due to its nutritional value. The popularity of oat is due to both its nutritional properties and its properties to induce the feeling of satiety. Most varieties of oats belong to the genus Avena. Among the cultivated oat varieties, Avena sativa (ordinary white oats) is the most important variety (DUȚĂ et al., 2016).

Of course, the production also depends on the specifics of the area, in other words a special efficiency is highlighted for the aclimatized varieties. On this principle, the genotypes that have the role of parents in the hybridization process are chosen, where we choose a zoned genotype and one that comes with a contribution of new characters.

In the case of oats, an important feature is the twinning process, because compared to other plants, the leaf area is not directly influenced by the density of seed sown. Thus, the more we sow a quantity of seed, the density being very high, the twinning of the plants is disordered; therefore, the formation of the leaf surface is more influenced by the environmental conditions than by the quantity of seed. Sowing very rarely causes the formation of an uneven crop, as well as a delayed ripening (SANDRU, 1993).

The most important care operations performed on oat crops are: crust control, weed control and pest control. Crust control is performed with the help of the star harrow. Weed control is done with the help of herbicides recommended by the specialists of the Plant Protection Laboratory, through the warning bulletins, which mention the name of the herbicide, the quantity and the moment of its application. In general, the time of application of herbicides is in the period from twinning to the beginning of straw elongation. The time of application must be well determined, because if the herbicides are applied earlier, the oat plants suffer and they reduce productivity, and the late application decreases after the effect of the applied herbicide, because it must become much more resistant. The most dangerous pest for oat culture is oat beetle (Lema melonopa). The control of this dangerous pest is done immediately after receiving the warning bulletin (DUȚĂ et al., 2016).

Due to its position, very close to the panicle and to the surface of the oat field, the flag leaf can intercept a considerable amount of light energy that it transformed into carbohydrates that will be translocated to the grains. The present study is a component of the efforts to characterize the comparative crops in order to use them in the oat breeding activity as well as in the studies of the physiology of crop formation (DOBRE and LAZĂR, 2014).

In terms of production parameters, oat is not very pretentious to the previous plant, but a very good production is obtained when the soil is rich in nutrients such as nitrogen and phosphorus. Oats give very good results when grown after peas, beans and potatoes. It is not recommended to be grown after itself or after sugar beet, until after a period longer than three years to prevent the attack of nematodes (SANDRU., 1993).
VOLDENG and SIMPSON (1967) showed that the leaf area of cereals is an indicator of productivity, and the flag leaf, being the most important leaf of the plant, can play a significant role. Fundulea described the background relationship between the size of the leaf area and the rate of net assimilation to cereal varieties grown in Romania (PETCU and al., 2007). Estimation of the leaf area, although insufficient as an isolated value, is indispensable for modeling evapotranspiration and photosynthesis during the period of maximum impact of these processes. BREMNER (1967) noticed a decrease in cereal production after the removal of the flag leaf. The flag leaf has a major importance in the life of the plant because it contributes about 75-80% to the total amount of photoassimilates, 75% in the process of filling the grain, 41-43% in the dry matter content of the grain at maturity, thus an essential role in the total productivity of the plant.

Oats are adapted to acidic soils and cold and humid climates than other cereals, but are sensitive to water and heat deficiencies during seed formation and maturity (MURARIU and PLĂCINTĂ, 2017). A change from warm to cold increases stem proportion but delays oat maturity, and change from cold to warm promotes earlier anthesis (CONTRERAS-GOVEA and ALBRECHT, 2006).

Because oat has value as feed for livestock, in human nutrition, and as a partial remedy for many production problems, methods to increase and stabilize oat grain yields are needed (HELLAND and HOLLAND, 2001).

In winter oats, the phenomenon is of lower intensity compared with spring oats. This is because winter oats straw is thicker, giving it greater resistance. Resistant forms have a well-developed root system and anchored in the soil, a strain reduced in height, thick with well-developed mechanical tissues. Some of these compounds are very stable, and once created are maintained over time (MADOŞĂ E et al., 2012).

MATERIALS AND METHODS
The experiment was conducted at S.C.D.A. Lovrin, Romania. The type of soil on which it was placed is chernozem, semicarbonate, poorly glazed and poorly alkalized, medium supplied with nutrients.

Regarding the climatic conditions of the area, the multiannual average of precipitation oscillates around 250 mm, and the multiannual average temperature is about 10.8 °C; with great oscillations in recent years.

The experimental field includes 15 variants, sown in four repetitions, according to the randomized block method; this experience is of the monofactorial type.

The parameters studied in this experiment were leaf area, leaf blade thickness and chlorophyll content. The flag leaf was used for the indicated determinations. In each of the 15 variants, 40 standard leaves were harvested and analyzed in the laboratory, using the following devices: LI-300 Portable Area Meter (leaf surface) and SPAD 502 Chlorophyllmeter.

The chlorophyllmeter determines the relative chlorophyll content by measuring the absorbance of a leaf in two wavelength ranges. The device calculates a numerical SPAD value that is directly proportional to the amount of chlorophyll in the leaf.

The results were interpreted statistically according to the variance analysis model.

RESULTS AND DISCUSSIONS
The experimental data obtained represent the value of the chlorophyll, the leaf area and the thickness of the leaf blade.

The ideal production for oats is about 6 tons per hectare, but depending on climatic conditions, technological and quality parameters, this value can fluctuate; which is why the production obtained is represented in this figure. Following the analysis of variance, the degrees of freedom indicate the differences obtained between the 15 genotypes. The first genotype is represented by the Sorin variety which is in fact the witness. In this experiment we observe 8 genotypes (5202, 5203, 5205, 5207, 5209, 5211, 5212, 5213) which fall with in the significance threshold of 0,1% which is a very significant difference.
Figure 1. Production variation

Figure 2 represents the value of chlorophyll for each genotype. Compared with the witness variant chosen for this experiment, the genotype marked with the number 5201 which is the control, 3 of the genotypes indicates a higher value of chlorophyll up to 5% higher. All other genotypes are below the witness value, 41.74 units SPAD. A significant value is obtained at genotype 5212 (64.73), which means an important chlorophyll content in the flag leaf. The lowest value is represented by genotype 2503 (57.61), which indicates a low chlorophyll content.

Figure 2. Chlorophyll variation

Figure 3 represents the value for the thickness of the leaf blade. For this purpose, we obtained an important result for genotype 2515 (0.231) which represents the thickness of the leaf blade in a more pronounced layer, and the lowest value is indicated by genotype 2508 (0.141).

Figure 3. Variation of leaf blade thickness
Figure 4 represents the variation depending on the leaf area. Regarding the leaf area, the values range from the maximum value recorded for genotype 2501 (34,14) to the minimum value recorded for genotype 2508 (9,70).

Analyzing the variation of the 3 indicators (fig.5), we can deduce that the chlorophyll content registers a low variation, given the value of the coefficient of variation (CV <10%), the thickness of the leaf blade registers an average variation between 10 and 20%, and the leaf area, a very large variation, with a coefficient of variation greater than 20%.

Figure 5 shows the correlation between the three parameters studied.

A very significant positive correlation is established between the value of chlorophyll and the thickness of the leaf blade, given the value of the correlation coefficient $r = 0.40$ ***. Between the determined leaf surface and the value of chlorophyll, the established correlation is a significant positive one, the value of the coefficient correlation being $r = 0.15$ *; and between the leaf surface and the thickness leaf blade, the resulting correlation is a very significant positive one, ($r = 0.46$ ***).

To compare the influence of each factor investigated on the leaf surface, we use the coefficients of elasticity, which show by what percentage on average the production will change when changing the value of the factors studied.
Table 1

<table>
<thead>
<tr>
<th>Indicators</th>
<th>XI (chlorophyll value)</th>
<th>X2 (leaf blade thickness)</th>
<th>X3 (leaf area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression coefficient</td>
<td>22.02</td>
<td>-3530.13</td>
<td>-0.33</td>
</tr>
<tr>
<td>Average value of factor studied (independent variable)</td>
<td>60.830</td>
<td>0.194</td>
<td>19.684</td>
</tr>
<tr>
<td>Average value of production (dependent variable)</td>
<td></td>
<td></td>
<td>5109.167</td>
</tr>
<tr>
<td>Partial coefficients of elasticity</td>
<td>0.26</td>
<td>-0.13</td>
<td>-0.001</td>
</tr>
</tbody>
</table>

Following the evolution of production in the analyzed period under the influence of the 3 factors studied, we can conclude the following: when the chlorophyll content increases by 1%, the production increases by 0.26%; when the thickness of the leaf blade increases by 1%, the production decreases on average by 0.13%; when the leaf area increases by 1%, the production decreases on average by 0.001%.

CONCLUSIONS

During the analyzed period, 8 of the 15 genotypes studied stand out as productivity, the production increases brought to the control being very significant positive, statistically assured for the probability of transgression of 0.1%.

Between the three parameters studied (fig.6), the multiple correlation between the leaf area, the thickness of the leaf blade and the chlorophyll content indicates an increase of the oval autumn production, with direct application in the current agricultural practice.

BIBLIOGRAPHY


