

Research on Assimilation and Some Elements of Productivity Concerning Crops, Corn and Soybeans, Treated with the Foliar Fertilizer “Agro Argentum Forte” under the Agricultural Development Research at Station Turda

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Bulletin USAMV series Agriculture 72(2)/2015
Print ISSN 1843-5246; Electronic ISSN 1843-5386
DOI 10.15835/buasvmcn-agr: 11717

ABSTRACT

Research was conducted at the Agricultural Research Development Station Turda, on Turda-Star corn and soy variety Felix, being treated with the foliar fertilizer AgroArgentumForte (B+H Solutions) in two different concentrations of 0.3% and 0.4%, applied in two treatments at 14 days from each other.

Production and quality indicators were higher both in case of corn as well as soybeans and on variants that were studied it was applied foliar fertilizer, the highest production being of 9100 kg/ha in corn, respectively of 4620kg/ha in soybeans.

Keywords: *corn, soybean, photosynthesis, production and quality indices.*

INTRODUCTION

Plants convert light energy into biomass through photosynthesis (Madjar Roxana and collaborators, 1999). Determining physiological processes of assimilation of plants treated with foliar fertilizers is essential for growth and development as a table vegetable, quality and production (Hanson P.J. & collaborators, 2000; Heller and collaborators, 1989).

Breath plants and soil are key links in the carbon cycle in which carbon dioxide CO₂ fixed by plants is returned to the atmosphere. The processes of metabolism of absorbed substances occurring in plants is a process by which the solar energy is used to transform CO₂ from the atmosphere into organic compounds (dry substance), in the presence of water (Körner C. & collaborators 1979; Rusu & collaborators 2005).

MATERIALS AND METHODS

Corn hybrid-Turda Star: Fertilizer: N20P20K0-200 kg/ha. Planting-density of 65,000 pl/ha; Soy, the variety-Felix: Fertilizer: N20P20K0-100 kg/ha. Planting-density of 750 000 pl./ha.

Assimilation measurements were made when the crops were fully formed, mature, ten readings being made 10 readings/variant x 3 repetitions in July and August. The research method used was indestructible (leaves were not detached from the plant) and was based on the use of a gas analyzer foliar CIRAS-3 which results in multiple physiological and environmental indicators, one of the most important being CO₂ assimilation rate = net photosynthesis (A = µmolm⁻²s⁻¹).

Measurements were done under semi-controlled conditions for a normal rate of carbon

dioxide CO₂ (390 $\mu\text{molm}^{-2}\text{s}^{-1}$), PAR variable (from 0 to 2000 $\mu\text{molm}^{-2}\text{s}^{-1}$); measured parameters were recorded automatically by computer (System PP US -2014).

The length of the measurement depended on the duration of tissue adaptation in the assimilation chamber (Fig. 1).

As regards the weather conditions in 2014, we can notice that monthly average temperatures and rainfall during the growing season have been far superior to the annual average of the last 58 years (Igneș M., 2015). From spring-summer till September, the average monthly temperature was normal concluding, there was a very good year for the phenophases of a normal crop growth and development (Fig. 2).

Regarding the rainfalls, we can notice that during spring they varied widely, from excessively rainy to normal, then it was excessively dry in June, as for July, precipitations were in much larger quantities from the annual average thus ensuring sufficient water in the soil which led to a better development of culture in phenophases of growth and accumulation in grain (maize and soy), (Fig. 3.).



Fig. 1. CIRAS 3.

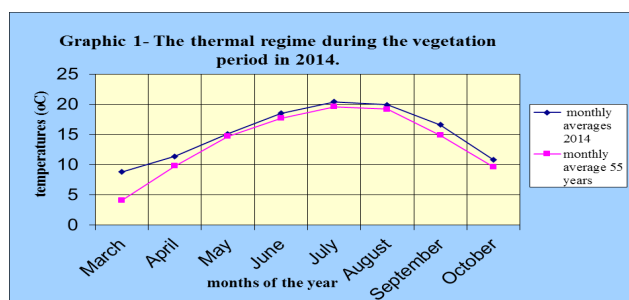


Fig. 2. Average monthly temperature

RESULTS AND DISCUSSION

In maize, hybrid Turda Star values are observed very high assimilation (A) and also a much lower evapotranspiration, is a C₄ plant, compared to C₃ plants (Burzo I. and collaborators, 1999; Delian E., 2013). It is noted that fertilized variants were statistically very significant precious, the highest values being recorded on the version foliar fertilizer with concentration of 0.3%, from 36.5 – 40.5 $\mu\text{molm}^{-2}\text{s}^{-1}$ and also the version fertilized by 0.4% from 39.5 to 44.5 $\mu\text{molm}^{-2}\text{s}^{-1}$ (Tab. 1).

The soybean crop, variety Felix has a lower assimilation, and intense evapotranspiration, is a C₃ plant, compared to C₄ plants (corn). Among untreated variant and variants treated with different concentrations of fertilizer, the soybean crop had values between 13.5 assimilation and 23.5 $\mu\text{molm}^{-2}\text{s}^{-1}$, at the 0.3% fertilization variant it had an average value of 18.6 assimilation $\mu\text{molm}^{-2}\text{s}^{-1}$ value being statistically significantly distinct and in case of the variant fertilized with 0.4% it had values between 18 to 23.5 $\mu\text{molm}^{-2}\text{s}^{-1}$, with an average of 20.5 $\mu\text{molm}^{-2}\text{s}^{-1}$ having a very significant difference (Tab. 2).

By comparing the values obtained in hybrid corn production Turda treated with the foliar fertilizers Agro Star Argentum Forte there was no difference between the embodiments of foliar fertilizer 0.3% and 0.4% in the study. Between the control variant and the variants on which foliar fertilizers were applied, production growth was distinctly significant, the highest average yields being obtained at the variants fertilized with 0.4% in the two cultures, in maize resulting in a production of 9100 kg/ha (Fig. 4). As regards the soybean harvests- variety Felix between the version of control and the variants treated with foliar fertilizer there were higher differences,

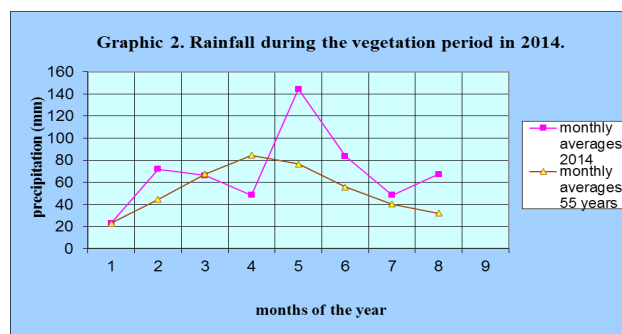


Fig. 3. Sum of precipitations

distinctively significant; as concerns the variants treated with the foliar fertilizer Agro-Argentum Forte there were no distinctive differences. The highest average yields were obtained on variants fertilized with 0.4%, at soy there resulted a production of 4620 kg / ha on one embodiment (Fig. 5).

Quality indices were done using NIR spectrophotometer on hybrid corn TANGO Star

Turda, where there were differences concerning the protein percentage between the variants treated with foliar fertilizer compared to the control variant. Thus, the variant fertilized with 0.3% resulted in an average protein percentage of 9.8% and it was distinctively significant in case of the variant fertilized with 0.4% where the average oil percentage was of 9.93%. Oil percentage differences between control version and fertilized

Tab. 1. Physiological parameters on the hybrid maize Turda Star, treated with foliar fertilizer AgroArgentumForte at the Agricultural Research and Development Station Turda.

Physiological parameters	Foliar fertilizer AgroArgentumForte		
	untreated control	concentration 0.3%	Concentration 0.4%,
Reference CO ₂ (CO _{2r} - μmolm ⁻² s ⁻¹)	390	390	390
CO ₂ assimilation rate (A-μmolm ⁻² s ⁻¹)	30.0-38.0 34.0	36.5-40.5 /*** 38.5	39.5-44.5 /*** 42.0
CO ₂ concentration. cavity substomatale (Ci - mmolm ⁻² s ⁻¹)	138	135	162
stomatal conductance to transfer overall (GS- mmolm ⁻² s ⁻¹)	306	496	806
leaf transpiration rate at (E - mmolm ⁻² s ⁻¹)	4,63	5,75	6,84
Photosynthetic active radiation (PAR)(0-2000) μmolm ⁻² s ⁻¹	1037	1082	858
The efficiency of water usage in photosynthesis- (WUE) mmol CO ₂ mol ⁻¹ H ₂ O.	4.14	4.44	4.85

Note: DL (p <5%) -3.38; DL (p <1%) -5,59; DL (p <0.1%) -10.47.

Tab. 2. Physiological parameters on the soybean variety Felix treated with foliar fertilizer AgroArgentumForte at the Agricultural Research and Development Station - Turda.

Physiological parameters	Foliar fertilizer AgroArgentumForte		
	untreated control	concentration 0.3%	Concentration 0.4%,
Reference CO ₂ (CO _{2r} - μmolm ⁻² s ⁻¹)	390	390	390
CO ₂ assimilation rate (A-μmolm ⁻² s ⁻¹)	13.5- 18.5 16,0	16.1-21.1 /** 18,6	17.5-23.5 /*** 20,5
CO ₂ concentration. cavity substomatale (Ci - mmolm ⁻² s ⁻¹)	265,5	260,0	257
stomatal conductance to transfer overall (GS- mmolm ⁻² s ⁻¹)	955	978,5	1100
leaf transpiration rate at (E - mmolm ⁻² s ⁻¹)	6,0	7,71	8,66
Photosynthetic active radiation (PAR)(0-2000) μmolm ⁻² s ⁻¹	1582,5	1600,5	1576,5
The efficiency of water usage in photosynthesis- (WUE) mmol CO ₂ mol ⁻¹ H ₂ O.	2,01	2,95	2,76

Note: DL (p <5%) -2.99; DL (p <1%) -4.95; DL (p <0.1%) -9.27.

different variants were significant but there were no differences between the two versions treated with foliar fertilizer yielding the highest average of 4.3% (Fig. 6.).

The percentage of starch had a higher mean value of 71.5% in the control variant, the variants with foliar fertilizer of 0.3% and 0.4% are statistically significantly negative of 70.7%, also of 70,1% (Fig. 6). Concerning the soybean cultivar Felix, quality indicators were also conducted with the help of NIR spectrophotometer TANGO

where there were protein differences between the variants treated with foliar fertilizer and the control variant version, therefore in the case of a 0.3% fertilization the value was of 39.7% which is significant compared to the control version.

Also, at the variant fertilized with 0,4% the value was of 40% protein, the difference being, as well, distinctively significant. The percentage of oil between variants treated with foliar fertilizer and control, at the fertilization variant of 0.3% the average was of 17.2% which is significant, also at the fertilization of 0.4%, there was an average of 17.5% oil, the difference is again significant. The percentage of starch value statistically obtained on variants with foliar fertilizers of 0.3% and 0.4% was distinctively negative decreasing by almost one percent compared to the control (19.1%), there being no differences between the fertilized variants (Fig. 7).

Regarding Star Turda hybrid maize, between the control variant and the other variants where foliar fertilizer was applied, MMB had a significant growth, the highest value being of 292.7 g, there being no differences between the variants that were fertilized (Fig. 8). With regard to the soybean

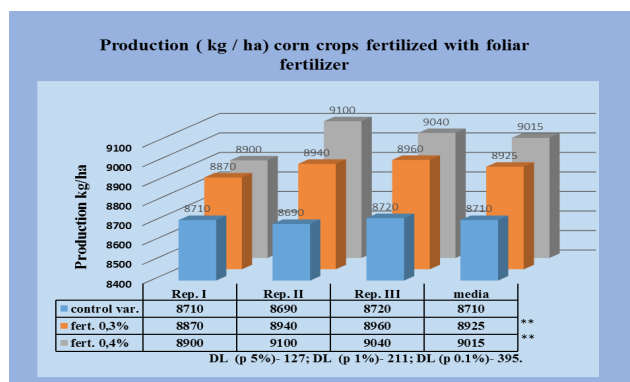


Fig. 4. Corn production in experimental variants

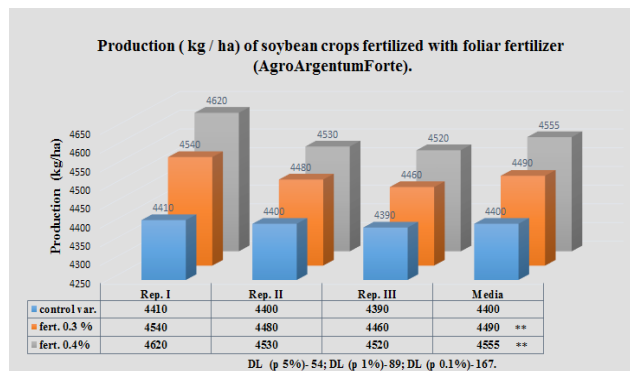


Fig. 5. Soybean production in experimental variants

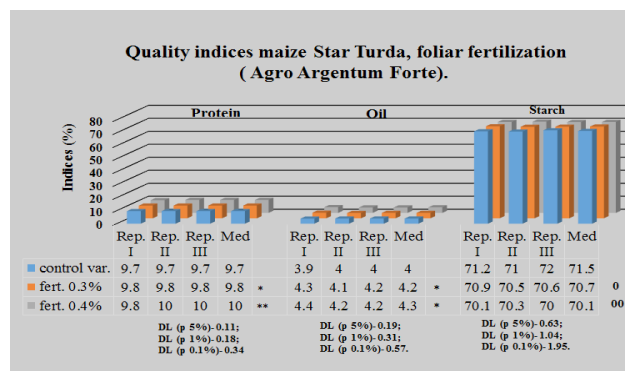


Fig. 6. Maize – quality indices

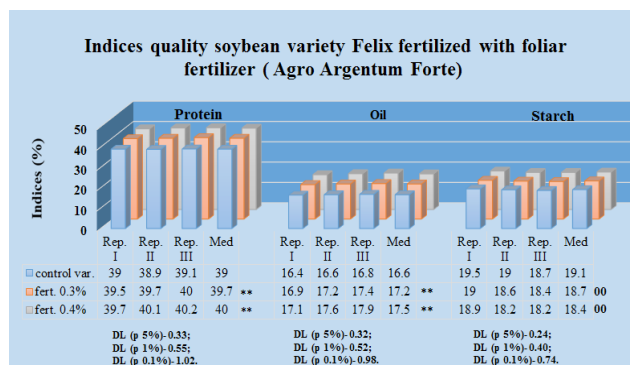


Fig. 7. Soybean – quality indices

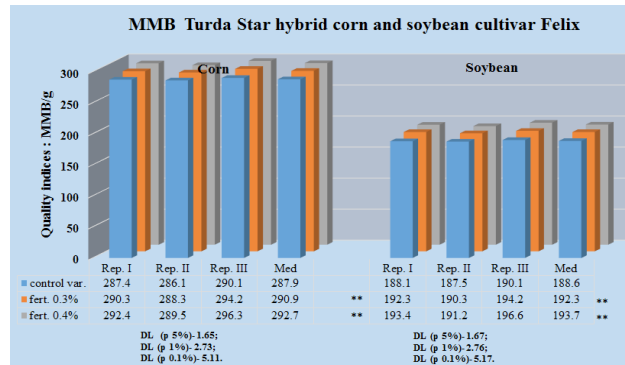


Fig. 8. Maize and soybean – production indices

-the cultivar Felix, for MMB there was a difference between control variant and those where foliar fertilizer was applied, at a concentration of 0.3% the difference was significant and at a variant of 0.4% concentration of foliar fertilizer the average values registered were of 192.3g and of 193.7g respectively, compared to the control variant.

CONCLUSIONS

In 2014, the climate throughout the growing season (April-September) of the two crops (corn, soybeans) was above the average multiyear, both at temperature (17°C), being the warmest year in the last 58 years, respectively, at humidity, of 463 mm which is second only to 2005, but they were all very favorable conditions as heavy rains fell exactly in the phenophases of growth and development of crops yielding higher productions.

The values obtained from the two crops, corn and soybeans, the rate of assimilation of CO₂ (A), the conductivity of stomata (GS) and wide leaf transpiration (E) and the efficiency of water use in photosynthesis (WUE), grow at the same time with the increasing concentration of foliar fertilizer.

By applying the foliar fertilizers AGRO ARGENTUM FORTE at the two cultures of corn and soybeans one can notice that the silver and nitrogen from the composition of the foliar fertilizers interacts with chloroplasts, the effect of photosynthesis being increased, causing an increase in the uptake of carbohydrates which makes the treated variants to be more vigorous plants with an increased biomass productivity and efficiency of culture (B + H Solutions).

Assimilation in maize and soybeans, has elevated values at the variants treated with

foliar fertilizer of 0.3% and 0.4%, values that were statistically significantly distinct and very significant.

In corn and soybean, production and quality parameters (protein, oil and MMB) had higher values at variants treated with foliar fertilizers, compared to the control variant, except for starch where negative values were obtained, decreasing, compared with the control variant, a fact which caused a rise in grain quality and production

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