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THE EFFECT OF FOLIAR FERTILIZATION IN ECOLOGICAL MAIZE PRODUCTION

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ABSTRACT
We examined the effect of foliar fertilization on the yield of maize in 2014. The experiment was set up on the area of an ecological farm in Hódmezővásárhely-Kútvölgy, Hungary. The trial was carried out in three replications. The soil was chernozem, the reaction of which was nearly neutral (pH_{KCL} 6.86). Before setting up the experiment, the soil analysis data showed that it had proper nitrogen, plenty of phosphorous and very good potassium contents. In 2014, the amount of precipitation in the vegetation period of maize was higher by 264 mm than the average, but its distribution was uneven. The preceding crop was winter wheat. Fall tillage involved deep ploughing at 30-35 cm depth. Secondary tillage in spring was made by heavy harrow, and seedbed preparation was made by a combinator. The foliar fertilizer was applied two times during the vegetation period of maize in a dosage of 5 l/ha. We harvested the parcels by hand. We processed the obtained data by single factor variant analysis. The yield of the control plots was 11.3 t/ha, on the average of 3 replications, the foliar fertilization plots' yield was 11.97 t/ha. The foliar fertilization increased the yield, but the difference between the average yields of control and foliar fertilization plots was not significant. Factual conclusion can be drawn only after the results of several years. We wish to continue our examinations.

Keywords: maize, organic farming, nutrient supply, foliar fertilization, environmental protection

INTRODUCTION

Today, organic farming is one of the fastest growing way of farming in the world. More and more people (producers, processors and consumers) think that it is the only form of long-term sustainable agricultural, which is able to produce healthy, safe, sufficient quality and nutrient-rich food with gentle use of the environment. In addition, it is the only form of production, which is almost the same everywhere in the world and it has a legal background. Legislation specifies the criteria for this form of farming, for all stages of the production from raw material production to food preparation, which is controlled by independent verification, certification organizations, (Hungária Öko Garancia Ltd., Biokontroll Hungária Nonprofit Ltd.) in compliance with state supervision (National Food Chain Safety Office) (ROSZÍK, 2008; ROSZÍK, 2010; JAKABNÉ, 2011). Indigenous breeds are of great importance in organic farming, both in crop production and animal husbandry (BENK, 2014).

Considering the aspects of efficiency and environment protection, maize needs only $N_{60\text{-}120}$, $P_2O_{5\ 45\text{-}90}$, $K_2O_{53\text{-}106}$ kg ha^{-1} active agent. With N doses larger than $N_{60\text{-}120}$ kg ha^{-1} the quantity of NO_3-N reaches 150-200 mg kg^{-1} in the 100-120 cm soil profile which can result in marked environment pollution (SÁRVÁRI, 1995).

The amount of precipitation in the crop year had a great effect on the nutrient utilization. VAD AND DÓKA (2009) examined the effect of crop year on the yield of maize. Their scientific results proved, that the effects of abiotic stresses could be strongly reduced by using the optimum crop models in maize production. They obtained 8.6-11.0 t/ha maximum yields of maize in water stress crop year and 13.7-14.2 t/ha in optimum crop year on chernozem soil with using appropriate agrotechnical elements.

SZÉLES ET AL (2012) found, that in 2007, the lack of rainfall caused yield stress in the non-irrigated treatment, in contrast to the significantly reduced yield in comparison with the non-irrigated treatment recorded in 2008, due to the extremely high amounts of rainfall.
KÁDÁR (2008) says that the macro and micro element requirements of most arable crops can be satisfied through soil. The future spreading of foliar fertilisation must be grounded by comprehensive experimental research. Accurate, repeated small plot trials are necessary to clarify the factors influencing the effectiveness of foliar fertilizers and recommendations must be developed for consultation.
Foliar fertilizers are unanimously considered stimulating and corrective products for mineral nutrition. They exhibit a secondary fertilizing role, that determines a significant increase of the productive consumption for soil elements and soil-applied elements without substituting root fertilization methods (through the soil), where foliar fertilizers are supplementary in balancing and optimizing the fertilization system applied to agricultural and horticultural plants (RYAN, 2002; DORNEANU ET AL., 2005; RUSU ET AL., 2008; TOADER ET AL., 2012).

MATERIAL AND METHOD

Soil properties of the experimental field

The experiment was set up on the area of an ecological farm. The soil was chernozem, the reaction of which was nearly neutral (pH_{KCL} 6.86). The soil analysis data showed that it had proper nitrogen, plenty of phosphor and very good potassium contents (*Table 1*).

Table 1. Main soil characteristics of the experimental field

pH (H_2O)	P_2O_5 (mg/kg)	K_2O (mg/kg)	Humus (%)	Soil plasticity value (K_A)
6.86	604	653	2.8	42

Weather in the experimental year

The year 2014 was favourable for maize production. In 2014, the amount of precipitation in the vegetation phase of maize was higher by 264 mm than the average, but its distribution was unfavourable. In July, the large amount of precipitation caused soil compaction and made soil aeration difficult. In August, the amount of precipitation was by 37 mm lower than the average. The lack of precipitation was unfavourable for the development of grains. A large amount of precipitation fell in September, which could not be utilized by the corn, therefore the corn harvest was delayed (*Table 2*).

Table 2. The distribution of precipitation in the vegetative period of maize in 2014

Month	Rainfall (mm)	Average rainfall (mm)	Difference (mm)
April	47	42	+5
May	88	47	+41
June	73	72	+1
July	218	60	+158
August	17	54	-37
September	128	32	+96
Total amount of rainfall (mm)	**571**	**307**	**+264**

Main features of the agro-technology applied

The small-scaled plough experiment was set up in three replications. The preceding crop was winter wheat. Fall tillage involved deep ploughing at 35 cm depth. Secondary tillage in spring was made by heavy harrow, and seedbed preparation was made by combinator. The foliar fertilization was applied twice (15th of May, 6th of June) in a dosage of 5-5 l/ha. During the vegetation period of maize mechanical weed control was made three times. We processed the obtained data by single factor variant analysis (SVÁB, 1981).

RESULTS

Without foliar fertilization, the yield of the examined hybrid was ranging between 10.66-11.84 t/ha. In control plots, the yield fluctuation was 1.18 t/ha. With foliar fertilization the yield was 11.81-12.07 t/ha. Under the influence of foliar fertilization treatments the yield fluctuation was lower 0.26 t/ha (*Table 3*).

Table 3. The effect of foliar fertilization on the yield fluctuation of maize (t/ha)

	1. repl.	2. repl.	3. repl.	yield (average repl.)	yield fluctuation
control	10.66	11.41	11.84	11.3	1.18
foliar fertilization	12.07	11.81	12.05	11.97	0.26
LSD 5%				1.60	

The yield of the control plots on the average of three replications was 11.3 t/ha. Under the influence of foliar fertilization the yield was 11.97 t/ha. The foliar fertilization had positive effect on the maize yield, but statistically the increase was not significant (LSD 5 %= 1.60 t/ha) (*Figure 1*).

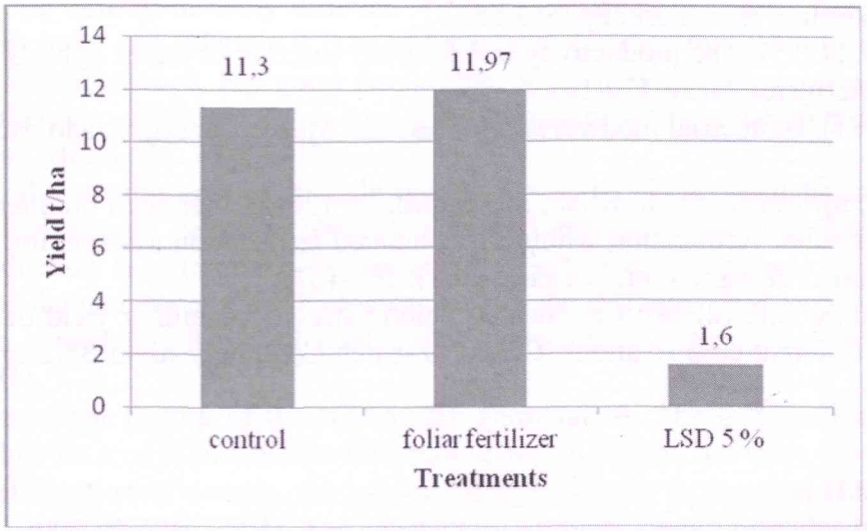

Figure 1. The effect of foliar fertilization on the yield of maize (t/ha)

CONCLUSIONS

We can conclude, that in our experiment the foliar fertilization had a positive effect on the yield of maize. The yield fluctuation decreased with the application of foliar fertilizers.

The foliar fertilization of corn is currently not part of the production technology. As KÁDÁR (2008) said, the future spread of foliar fertilization should be grounded by a comprehensive experimental research. Accurate, repeated small plot trials are necessary to clarify the factors influencing the effectiveness of foliar fertilizers and to develop proposals for consultancy. Our experiment and its continuation also serve this purpose.

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