

STUDY OF FOLIAR FERTILIZATION ON THE YIELD, CHEMICAL COMPOSITION AND NUTRIENT VALUE OF CORN

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Abstract: In our research we studied the effect of foliar fertilization on the yield, chemical composition and nutrient value of corn in 2015. The experiment was set on the area of Tangazdaság Ltd. The soil of the experiment was meadow chernozem. Beside the control we applied a foliar fertilization treatment. The average yield of control plots was 6.38 t/ha, and the average yield of treated plots was 6.5 t/ha on the average of three replications. The foliar fertilization increased the yield of corn, but the increase was not significant. The results of chemical composition analysis showed significant differences on LSD % of crude fat content, which decreased with 0.36% from 29.87g/kg to 26.49 kg. The other examined parameters (dry matter, crude protein, crude fibre, crude ash, N-free extract, and starch content) were higher in treated parcels, but the difference was not significant. The value of ME was lower in the treated parcels, but this difference was not significant either.

Key words: corn, foliar fertilization, chemical composition, nutrient value, yield,

INTRODUCTION

The use of corn is very versatile, because it is important not only as animal feed. The quality requirements are different. As a forage crop, its protein content and amino acid composition are important. In terms of human nutrition protein is also decisive, but the composition of the starch is also important, that is to contain the right proportion of amylose and amylopectin. The nutrient value of corn is lower than that of wheat. The animal nutrition and human nutrition are important factors to increase the protein content of corn [1].

The quality and biological value of the corn are determined by the oil and protein content, amino acid and fatty acid composition. The feeding value of corn protein is low, because it contains large amounts of gluten and zein. These proteins contain a small amount of essential amino acids as tryptophane, methionine and lysine [7, 9, 10].

The macro and micro element requirements of most arable crops can be satisfied through the soil. The future spread 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 [4].

The foliar fertilization increased the yield, but it was not significant. With foliar fertilization the crude fat increased while the N-free extract decreased significantly. The results showed that there was no considerable difference in the energy contents of control and treated corn [3].

Soil test results from the last few years show that in Hungary due to the intensive corn production decreased the zinc content of soils sharply. The soil might have a relative zinc deficiency even with a good supply of zinc, which is caused by the antagonism of phosphorus and zinc uptake in areas where the phosphorus content is very high [2,5,6]

MATERIAL AND METHODS

Soil properties of the experimental field

We set the experiment on the area of Tangazdaság Ltd. in Hódmezővásárhely. The soil was meadow chernozem, the reaction of which was nearly neutral (pH_{KCL} 7.17). Before setting the experiment the soil analysis data showed that it had good nitrogen, and very good phosphor and potassium contents (*Table 1*).

Table 1.

Main properties of the experimental field area

pH (KCL)	P ₂ O ₅ (mg/kg)	K ₂ O (mg/kg)	Humus (%)	Soil plasticity value (K _A)
7.17	336	620	3.39	48

Weather in the experimental years

The year 2015 was unfavourable for corn production. In 2015 the amount of precipitation in the vegetative period of corn was lower by 83.4 mm than the average. The average temperature showed a positive deviation compared to the average of several years. The positive deviation of average temperature together with deficient precipitation had a negative effect on the development of corn, which resulted in low yields. (*Table 2*).

Table 2.

The distribution of precipitation in the vegetative period of corn in 2015

Month	Rainfall (mm)	Average rainfall (mm)	Difference (mm)
April	7.6	39.9	-32.3
May	75.5	58	17.5
June	12.2	75.3	-63.1
July	61.6	58.7	3.0
August	51.8	48.7	3.1
September	29.0	40.7	-11.7
Total amount of rainfall (mm)	237.7	321.1	-83.4

Main features of the agro-technology applied

Our small-scaled plough experiment was set in three replications, organised as a random block in 2013. We applied foliar fertilization treatments, which we supplemented with a control plot. The foliar fertilization was applied twice (31 of May, 6 of June) in a dosage of 1 l/ha. The fore-crop was corn. Fall tillage involved deep ploughing at 32 cm depth in the experimental years. The corn hybrid in the experiment was DKC 4025 (FAO 340). We harvested the plots by hand. We processed the obtained data by single factor variant analysis [1].

Laboratory analyses

The laboratory analyses have been carried out in the feed analyses laboratory of University of Szeged Faculty of Agriculture. The applied methods: Dry matter MSZ 6830/3-84, crude protein Kjeldahl system, crude fat Pabulus Hungaricus (2004), crude fibre MSZ 6830/7-81, crude ash MSZ 6830/3-85, starch MSZ 6830/18-79.

RESEARCH RESULTS

Without foliar fertilization the yield of the examined hybrid was ranging between 6.2-6.66 t/ha. In control plots the yield fluctuation was 0.46 t/ha. With foliar fertilization the yield was 6.23-6.79 t/ha. The yield fluctuation in the foliar fertilization treatments was higher than in control plots 0.56 t/ha (*Table 3*).

Table 3.**The yield and yield fluctuation in the control and foliar fertilization plots (t/ha)**

	1. repl.	2. repl.	3. repl.	yield (average repl.)	yield fluctuation
control	6.66	6.2	6.3	6.38	0.46
foliar fertilization	6.79	6.23	6.5	6.5	0.56
LSD 5%				1.31	

The yield of the control plots in the average of three replications was 6.38 t/ha. Under the influence of foliar fertilization the yield was 6.5 t/ha. There was no significant difference between the yields (LSD 5 % = 1.31 t/ha). The foliar fertilization resulted in a little yield increasing, but was not significant. It is necessary to continue the experiment to explore the exact reasons because the results of at least three years are needed to draw the correct conclusions about the continuation of the experiment.

We studied the effect of foliar fertilization on the chemical composition and nutritive value of corn seeds. The results of chemical analyses are presented in Table 4. We compared the results of untreated control with treated ones with statistical analyses as well. The dry matter content was 892 g/kg of control and 895 g/kg almost the same. The crude protein content increased in treated corn with 1.2 gram for 57.1 g/kg. The crude fat content in treated corn decreased with 3.4 g/kg. This decrease was significant which was significant on LSD 5% level (LSD5%=0.3). The crude fibre, crude ash and N-free extract of treated corn increased, but the increase was not significant. There was no considerable difference in starch content. It was 702.2 g/kg of control, and 709.5 g/kg of treated seeds.

The energy content was related to the poultry metabolisable energy (ME). The results showed that there was no considerable difference in the energy contents of control and treated corn. The ME was 12.1 MJ/kg of control, and 14.0 MJ/kg of treated seeds.

Table 4.**The results of chemical analyses of corn seeds**

Name		control	treated	LSD 5%
Dry matter (DM)	g/kg	892	895	n.s.
Crude protein (CP)	g/kg	55.9	57.1	n.s.
Crude fat (CFat)	g/kg	29.9	26.5	0.3
Crude fiber (CF)	g/kg	44	44.8	n.s.
Crude ash (CA)	g/kg	7.3	7.5	n.s.
N-free extract	g/kg	754.9	759.3	n.s.
Starch	g/kg	702.2	709.5	n.s.
Poultry				
Metabolisable energy (ME)	MJ/kg	12.1	12.0	n.s.

CONCLUSIONS

Today, in order to achieve high yields of cultivated plants cannot always get enough microelements from the soil, therefore the importance of foliar fertilization. increased. The timing is decisive, rapid and effective intervention to prevent yield loss or deterioration, and we can achieve yield increase and quality improvement as well. With the application of foliar fertilization we can increase the resistance of corn against the ecological stress factors, diseases and pests as well.

In our study, we examined the effect of foliar fertilization on the yield, chemical composition and energy content of corn. The results showed that the yield increased slightly due to the foliar fertilization. The chemical composition and energy content of the corn grain, did not change significantly due to the foliar fertilizer. This result is probably

due to the fact that the good soils with nutrients necessary for corn could provide macro-, meso- and micro elements.

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