

EFFECTS OF FOLIAR FERTILIZERS ON MAIZE INBRED LINES

Milan BRANKOV^{1*}, Milena SIMIC¹, Sava VRBNICANIN², Vesna DRAGICEVIC¹, Igor SPASOJEVIC¹

¹Maize Research Institute „Zemun Polje“ Beograd-Zemun, Serbia

²University of Belgrade, Faculty of Agriculture, Serbia

(Corresponding author: mbrankov@mrizp.rs)

Abstract

Crop fertilization is one of the most important cropping practises. Fertilisation provides optimal plant growth and development. Foliar fertilizing enables rapid absorption and quick plant response to applied fertilizer. Foliar fertilizing also can contain microelements and amino acid. The aim of this study was to examine effect of two foliar fertilizers (formulation: 12:4:6+0.2MgO+ME+AA and 10:40:10+4MgO+ME) on five maize inbred lines. The first fertilizer was applied at the 5-6 leaf stage of maize, while second in 11-12 leaf stage. Influence of foliar fertilizers was examined on fresh matter at 48h, 21 day after application and in flowering stages and on grain yield. Application of foliar fertilizers increase fresh matter in maize lines in all examined stages compared to control. The greatest differences in fresh matter were recorded for 21 days after application of foliar fertilizers compared to control. Foliar fertilizers also increased grain yield of maize lines. Although both fertilizers significantly increased fresh matter and grain yield, the first fertilizer (12:4:6+0.2MgO+ME+AA) shows as better than the other tested fertilizer.

Key words: maize inbred lines, foliar fertilizers

Introduction

Fertilization is one of the most important cropping practices that provide optimal plant growth and development. Fertilizing could be classified as basic and foliar fertilizing. Genetic potential is closely linked with fertilizing. Optimal nutrition also implies better condition and contributes to greater resistance to abiotic and biotic stress, first of all to drought, diseases and pests (Varallyay, 2006). Plant response to foliar fertilisation is quick due to rapid absorption of elements (Oosterhuis, D., 2009). Foliar fertilizers generally include microelements and amino acids that have positive effect on plants. In seed maize crop herbicide application is unavoidable practice, mixed application of herbicide and foliar fertilizers could lead to diminishing of herbicide stress (Brankov et al., 2011.). An additional impact of foliar N application is reflected through better maize yields (Abdel-Hamid et al., 2006; Shirvani Sarakhsi et al., 2010.). On the other hand, fertilisers incorporated into basic formulations are subjected to leaching, impact of microorganisms, etc., when they become inaccessible to plants (Lopez-Bellido et al., 2006). Dragi eviC et al. (2010) also stated that foliar fertilising affects the increase of plants fresh matter and therefore it positively affects the plant growth.

The objective of the present study was to test effects of two formulations of foliar fertilisers applied on fresh matter and grain yield of five maize inbred lines.

Material and methods

Field experiment was set up at slightly calcareous chernozem in the experimental field of the Maize Research Institute, “Zemun Polje”, during 2010 and 2011, with wheat as a preceding crop in both years. The aim of experiment was to test effects of two foliar fertilizers on five maize inbred lines by measuring fresh matter and grain yield. Foliar fertilizers were applied in different phase of maize growth: foliar fertilizer F1 - Activeg (12:4:6+0.2MgO+ME+AK) was applied at 5-6 leaf stage, while F2 Soluveg Green (10:40:10+4MgO+ME) in 10-12 leaf stage of maize. The four-replicate trail was set up according to the split-plot arrangement. The elementary plot size was 16.8m², while the plant density amounted to 60,000 plants ha⁻¹. Maize inbred lines were sown manually on April 26 and 27 in both years. Samples of four plants for measuring plant fresh matter were taken 48 hours and 21 days after foliar fertilizers were applied. In flowering stage fresh matter of maize leaves were measured. Maize grain yield was measured after harvesting and was calculated at 14% moisture. Obtained data were statistically processed by ANOVA and differences between means were tested by the least significant difference (LSD_{0.05}). Meteorological data collected during the trail duration are presented in table 1.

Table 1. Precipitation and average air temperatures for the period April-October 2010/11

Months	Precipitation (mm)		Temperatures (°C)	
	2010	2011	2010	2011
April	44.0	14.9	13.2	13.4
May	64.1	89.6	17.5	16.8
June	167.3	26.2	21.0	21.5
July	35.6	44.0	23.2	23.3
August	68.2	66.0	23.1	23.9
September	68.0	32.6	17.6	21.6
Average	447.2	273.3	19.3	20.1

Results and discussion

First recorded differences in treatments were recorded 48 after foliar fertilizers application. All lines, except L3, had higher values of fresh matter comparing to the control treatment in first foliar fertilizer (F1). In average there was an increasing of 25.7% on F1 treatment than in control. On the other hand, second foliar fertilizer (F2) increased average fresh matter 40.3% comparing to control. Due to late application of F2 there are higher values of estimated fresh matter. It is interesting to emphasize that L3 on F2 had the best response to fertilizing (increasing of fresh matter of 57.2% comparing to control) (Table 2).

Similar results were recorded at second measurement, 21 days after foliar fertilization application (Table 3). Both fertilizers statistically increased fresh matter of maize inbred lines. First foliar fertilizer increased average values of fresh matter 16.1%, while second (F2) for 13.9%.

Table 2. Effects of foliar fertilizers on fresh matter of maize inbred lines 48h after foliar fertilizer application, (g plants⁻¹) average 2010/11.

	Fresh matter of plants (g plant ⁻¹)					Average
	L1	L2	L3	L4	L5	
Control	10.9	5.5	13.1	11.7	5.6	9.36 b
F1	15.2	8.0	13.1	15.9	10.7	12.6 a
Average	12.8	6.7	13.1	13.8	8.1	
Control	112.6	127.7	142.4	136.5	56.5	115.1
F2	210.5	150.4	332.9	162.5	108.4	192.9
Average	161.5	139.0	237.6	149.5	82.4	

Table 3. Effects of foliar fertilizers on fresh matter of maize inbred lines 21 days after foliar fertilizer application, (g plants⁻¹) average 2010/11.

	Fresh matter of plants (g plant ⁻¹)					Average
	L1	L2	L3	L4	L5	
Control	112.6	127.7	142.4	122.3	56.5	112.3 b
F1	162.1	133.9	147.8	160.3	65.2	133.9 a
Average	137.3	130.8	145.1	141.3	60.8	
Control	209.4	275.9	342.3	315.4	267.7	282.1 b
F2	271.8	300.9	403.8	382.4	279.9	327.8 a
Average						

According to obtained results first foliar fertilizer significantly increased fresh matter of maize leaves (Table 4), while second fertilizer was not record increased values of fresh matter. Lines L1 and L5 showed the highest increase of fresh matter (6.6% and 11.6%). The fresh matter also varied among genotypes, but considering their belonging to various maturity groups, such results had been expected.

Foliar fertiliser did not only affect the fresh matter of maize inbreds, but also induced the yield increase (Table 5). Grain yield was higher in both treatments with foliar fertilizer comparing to control. Similarly, Dragi eviC et al. (2010) and Brankov et al. (2011) stated that the application of foliar fertiliser increased maize grain yield. The highest average yield in all five maize inbreds was measured in the treatment F1 (increasing of 15.2% comparing to control), which had been applied at the 5-6-leaf stage, while a somewhat lower yield was registered in the F2 treatment (increasing of 11.4% comparing to control). The grain yield of L2 and L3 expressed the lowest variation under the influence of applied fertilisers in relation to the control. Statistical analyses indicated significantly differences between treatments with foliar fertilizers and control.

Table 4. Effects of foliar fertilizers on fresh matter of maize inbred lines at flowering stage, (g leaf⁻¹) average 2010/11.

	Fresh matter of leaves (g plant ⁻¹)					Average
	L1	L2	L3	L4	L5	
Control	162.1	254.6	301.3	360.1	290.6	273.7 b
F1	173.6	250.4	316.1	372.1	328.9	288.2 a
F2	163.1	254.6	301.3	360.1	290.6	273.9 b
Average	166.3	253.2	306.2	364.1	303.4	

Table 5. Maize grain yield, average 2010/11.

	Grain yield (t ha ⁻¹)					Average
	L1	L2	L3	L4	L5	
Control	1.86	3.11	6.09	5.6	2.81	3.9 b
F1	2.57	3.26	6.28	6.43	4.39	4.6 a
F2	1.97	3.19	6.21	5.6	5.03	4.4 a
Average	2.13	3.19	6.19	5.88	4.08	

Conclusion

Based on obtained results it can be concluded that the application of foliar fertilisers significantly increased fresh matter of maize inbred lines. Foliar fertilizing enables fast and rapid plant response and could provide better growth condition. As a result of foliar fertilising plants of maize lines had higher total fresh matter, and grain yield comparing to control. However, the treatment with the formulation F1 expressed better results regarding measured parameters than the treatment with the formulation F2.

Acknowledgements

This study was supported by the Ministry of Education and Science of the Republic of Serbia (Project TR-31037).

References

- Oosterhuis, D. (2009): Foliar Fertilization: Mechanisms and Magnitude of Nutrient Uptake. In: Proc. Fluid Fertilizer Foundation meeting, 15-16 Feb. 2009, Phoenix, Ariz.
- Varallyay G. (2006). Soil degradation processes and extreme soil moisture regime as environmental problems in the Carpathian Basin. *Agrokemia es Talajtan*. (55): 9-18.
- Brankov, M., Dragi evi , V., Simi , M., Vrbni anin, S., Spasojevi , I (2011): The foliar application of herbicides and mineral fertilizer in maize inbred lines. V Symposium with International Partipication: Innovations in Crop and Vegetable Production, 20-22.October, Belgrade.
- Shirvani Sarakhsi H., Yarnia M., Amirniya, R. (2010): Effect of nitrogen foliar application in different concentration and growth stage of corn (Hybrid 704). *Adv. Environ. Biol.* (4): 291-298.
- Lopez-Bellido L., Lopez-Bellido R., Lopez-Bellido F. (2006). Fertilizer Nitrogen Efficiency in Durum Wheat under Rainfed Mediterranean Conditions. *Agronomy Journal*. (98): 55-62.
- Brankov, M., Simi , M., Vrbni anin, S., Dragi evi , V., Spasojevi , I., Kresovi , B. (2012): The influence of foliar fertilizers on morphological traits of maize inbreds. 47th Croatian and 7th International Symposium on Agriculture, 13-17 February, Opatija.