THE ANALYSIS OF THE ORGANIC MATTER YIELD OF THE MAIZE FORAGE USING FOLIAR FERTILIZER "SINERGON 2000" AND MINERAL NITROGEN

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Abstract. *Maize is the main component in nutrition of domestic animals, not only for concentrated food, but for silage too. That is why the aim of this study was to examine the influence of the combination of the classic fertilization and foliar fertilization of the maize as well as its influence on the increase of the organic matter and protein in green mass. The study was conducted in the area of Mokro (43°52'34.03" (N) 18°36'28.56"(E) and 905mamsl), on land of the dystric cambisol type, in 2013. All agro technical measures were conducted on time and with quality. The influence of increasing doses of mineral nitrogen in fertilization on components of organic matter yield of the maize hybrid NS 3014, which is characterized by properties convenient for preparation of silage in mountainous area was examined, as well as foliar organomineral fertilizer "Sinergon 2000" which contain N, P, K, and more important microelements. Maize was additionally fertilized in phenophase of 6 leaves. Foliar usage of "Sinergon 2000" did not have significant impact on the increase of forage yield, and organic matter, but the increase in all variables of fertilization was noticeably increased.*

Key words: *maize, "Sinergon 2000", nitrogen, forage, protein, organic matter*

INTRODUCTION

Maize as the most used culture in Republic of Srpska makes the basic component of concentrated feed for all kinds and categories of domestic animals. For the production of the seed in the Republic of Srpska territory maize is produced on more than 1400 000 ha, while the surface areas under maize for silage are significantly smaller and amount to 45 000 ha. With high production of maize biomass for silage, the production surface areas are used more effectively and crop production furthers significantly, which contributes to the development of crop production (ĐUKIĆ AND STEVOVIĆ, 1997). Thanks to high energetic value, good digestibility and microbiological correctness, maize silage is one of the most important nutrients for domestic animals. Maize is the kind that has wide specter of widespread, on north hemisphere it is cultivated from Ecuador to 60 º North latitude. The expansion of its area of cultivation is the result of work on creation of the hybrids of shorter vegetation, which can be cultivated in the regions where period whithout freezing lasts 90 and more days. As tropical plant maize is sensitive to freezing and to the lack of water. Minimal temperature for the initial growth and the development amounts up to 8 °C, and in vegetation 12 °C. Optimal temperature in vegetation is from 24 to 28 °C. The part above ground melts on -1 °C. If frost occurs when maize has 6 or more leaves, the crop is destroyed. 500 to 600 mm of water during vegetation is necessary for good yield and the biggest necessity in the phase of silking – fertilization and filling of the seed. Fertile, deep, passable, loose ground fits it the most,

and light sandy and hard clay land is less suitable. The area in which the experiment was conducted belongs to mountainous area of the Republic of Srpska and is located on 860mamsl to 1627mamsl. The climate of this area is distinctively mountainous, with harsh winters and fresh summers (MIĆEVIĆ, 1979) so late spring frost occurs often (until the middle of May), and also early autumn (even in September). The aim of this study was to analyze the qualitative composition of green mass of the maize by using foliar organomineral nutrient "Sinergon 2000", as well as the growing doses of mineral nitrogen in fertilization, in unfavorable mountainous conditions.

MATERIAL AND METHODS

Field study was conducted in the area of Mokro (43°52'34.03" (N) 18°36'28.56"(E) i 905mamsl) on dystric cambisol land type, (RESULOVIĆ ET AL., 2008), with light mechanical structure (total sand 59,0%, dust 35,3%, clay 5,7%), acid reaction (pH KCl 5,17), with the content of humus 5,1%, CaCO3 1,1%, P2O5 1,43 mg 100g-1 and K2O 34,3 mg 100g-1 of the land. The study was set on block system by chance in four repetitions. Together with pre-sowing preparation, 300 kg ha-1 NPK 15:15:15 was put into the land. On the main parcel (2,8 x 10 m) four rows with the density of 68 027 plants ha-1 (70 cm x 21 cm) were planted. Maize hybrid NS 3014 (Institute for Field and Vegetable Crops, Novi Sad) of the FAO group of ripening 300 was used for the sowing. Sowing was conducted post-deadline 17 June 2013. In the phase of six leaves foliar fertilizer "Sinergon 2000" (Cifo, Italija) was applied in two variants: untreated and "Sinergon 2000" in the amount of 2 l ha-1, with water usage of 300 l ha-1. "Sinergon 2000" is a liquid organic fertilizer for foliar appliance and contains 4% organic nitrogen, 12 % organic carbon, 2% MgO and 0,5% Fe. Amino acids from the organic part have positive impact on protein synthesis in plant in stressful conditions, so that it becomes more resistant, vital and productive and thus resists stress in a better way. In combination with variants of foliar fertilizer the next variants of fertilization with mineral nitrogen (N) (KAN, 27% N) were applied: unfertilized, 40, 80 and 120 kg ha-1 N. Fertilization was conducted in the phase of five leaves. In the phase of milk maturity of the maize seed from basic parcels the number of plants and the mass of green forage was determined by measuring the weight of all plants from two central rows from every basic parcel and the yield in t ha-1 was recalculated. For chemical analysis the sample of 8 plants was taken, out of which, after shredding, the sample for determination of the content of: dry matter, protein, cellulose, fat, mineral matter, was separated, based on which the share of non-nitrogen extractive matter (BEM) was recalculated. The share of organic matter of maize forage represents the sum of the following components (protein, cellulose, fats and BEM). Chemical analysis was conducted in accredited laboratory Sistem Qualita S d.o.o. Pale, using standard methods. Obtained results of the number of the plants, yield of green forage, dry matter and protein were processed by analysis of variance of dual-factor experiment ("Sinergon 2000", mineral nitrogen). The significance of differences of average values was tested by LSD- test (IBM SPSS Statistics software). Climate parameters (air temperature and precipitation) were taken from meteorological station Sokolac.

Table 1

Average monthly air temperatures and monthly sum of precipitation in vegetation period 2013 and perennial average (2003-2012) (Meteorological station Sokolac).

Month	Average monthly t (ºC)		Monthly sum of precipitation (mm)	
	2013	Perennial average	2013	Perennial average
April	8,9	7,6	44,0	57,3
May	12,5	12,2	121,5	95,6
June	15,6	16,2	41,4	101,2
July	18,1	17,9	28,4	82,6
August	18,5	17,6	70,6	56,0
September	12,3	12,8	108,0	75,4
October	9,4	7,9	78,5	87,6

Average monthly temperatures in period of vegetation were mostly on the level of perennial average (table 1). The appearance of the first autumn frost, which caused discontinuation of the vegetation, was recorded on 4 October 2013. Total sum of precipitation in the period of conducting the study was much lower in comparison with perennial average. The deficit of humidity was especially expressed in July and June, when the sum of precipitation was 2.5, or over 2 times lower, respectively, in comparison with perennial average. The lack of precipitation in July coincides with phenophase of intensive growth, one of the critical periods of the maize for the humidity.

RESULTS AND DISCUSSION

In the Republic of Srpska, in the production of maize silage, many current maize hybrids of various groups of maturity are used, depending on whether it is a regular term of sowing or an afterward or late time of sowing. In both named cases the number of the plants per unit of the surface area, as well as mass of the plants, have crucial influence and also agro-ecological conditions during summer months (lack of precipitation). In our case the occurrence of early frost in October, 6 October 2013, had influence on earlier interruption of vegetation, and that was in the moment of milk maturity of the maize. In our studies we showed the results of green mass of the whole maize plant in the given moment. The results of the study showed that there was not a bigger influence of the “Sinergon 2000” on the yield and the growth of organic matter, but that the significant growth of the green mass yield, as well as organic matter was in the variant with the greatest dose of the fertilization with nitrogen (120 kg), these results can be explained by the lack of precipitation in June and July (which were far below the average 41,4 mm and 28,4 mm) in the time of intensive growth as well as in inhomogeneous parcel on which the study was conducted.

Table 2

Analysis of average value of the green mass yield tha^{-1} at different doses of fertilization with nitrogen and foliar usage of "Sinergon 2000"

„Sinergon 2000"/Fertilization N	Control 0kg N	40 kg N	80 kg N	120 kg N	Average
Untreated S2000	26,11	34,87	47,43	46,20	38,65
Sinergon 2000	31,72	33,33	42,91	39,29	36,82
Average	28,92	34,09	45,17	42,74	37,73

LSD	A	B	AxB
0,05	5,45	7,71	10,91
0,01	7,26	10,27	14,53

Statistical analysis showed statistically high significant difference in all variants with fertilization with nitrogen, therefore we can conclude that with the increase of the nitrogen dose, the increase of green mass yield of the maize forage increases too. Also, we can see that foliar fertilizer "Sinergon 2000" did not have influence on the increase of the forage yield.

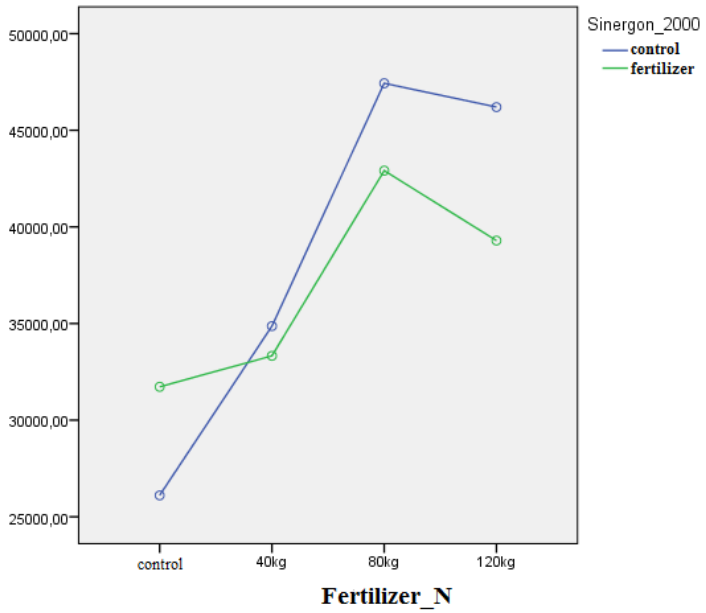

Figure 1 Graphical representation of average values of the yield of green forage of the maize kg ha^{-1} at different treatments with fertilizer

Table 3

Analysis of the average values of organic matter yield tha-1 at different doses of fertilizer with nitrogen and foliar usage of "Sinergon 2000"

„Sinergon 2000"/Fertilization N	Control 0kg N	40 kg N	80 kg N	120 kg N	Average
Untreated S2000	10,15	12,19	14,74	17,67	13,69
Sinergon 2000	12,98	11,73	14,27	14,67	13,41
Average	11,56	11,96	14,50	16,17	13,55

LSD	A	B	AxB
0,05	1,99	2,77	3,92
0,01	2,61	3,69	5,22

As we can conclude from the previous table, with the increase of the nitrogen dose comes the increase of the protein in green forage of the maize and together with that happens the increase of the share of the organic matter. The analysis showed statistically high significant difference in all variants with the fertilization with nitrogen. In the same way, the foliar fertilizer "Sinergon 2000" did not have influence on significant increase of the yield of the forage and organic matter, but the increase is observable on all variants of the fertilization with nitrogen. Bad influence of the foliar fertilization can be explained by poor adoption of the plants themselves as well as inhomogeneous state of the parcel itself where the maize was located, even though the combined effect with fertilization with nitrogen and foliar treatment showed the increase of the organic matter share. The content of the organic matter is in direct dependence on the content of the raw protein and their content is, to a large degree defined by the supply of the plant N. The increase of their content proportionately increased dose of N fertilizer is suggested by ULGER ET AL. (1997), AMES ET AL. (2003), BARRACLOUGH ET AL. (2010), in maize seed, VUKOBRATOVIĆ ET AL. (2008) in the ear of maize and STEVOVIĆ AND ĐUKIĆ (2002) in forage. The decrease of the cellulose content during the increase of the quantity of the N in fertilization can be explained by the fact that plants that accumulate carbo hydrates during bigger fertilization N have heightened synthesis of the proteins and fats, by which the content of the carbo hydrates decreases (KASTORI, 1983).

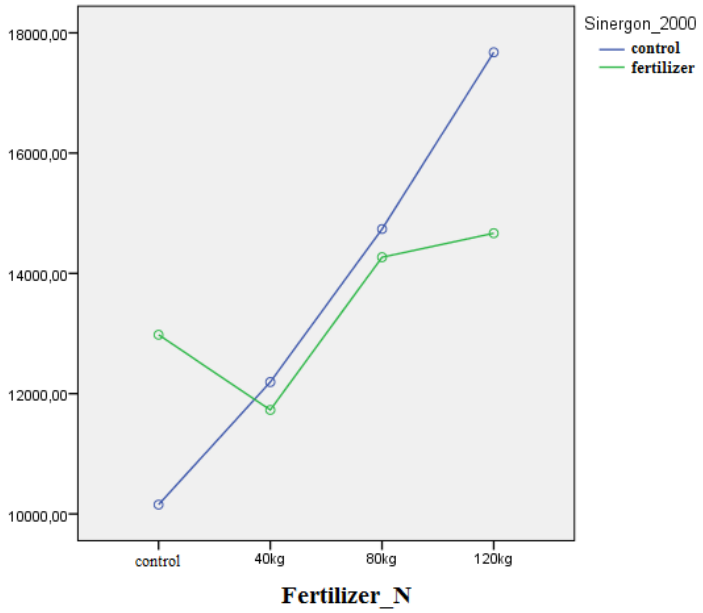

Figure 2 Graphical representation of the average values of the organic matter yield of the maize kg ha-1 at different treatments of the fertilization

CONCLUSION

In the given studies, foliar usage of foliar fertilizer "Sinergon 2000" did not have influence on a significant increase of the yield of forage and organic matter. The reason for that is the lack of precipitation in June and July, i.e. in the period of intensive growth of the maize. One of the reasons is inhomogeneity of the parcel on which the study was conducted, as well as the appearance of the limiting low temperatures for the growth and development of the maize (including the appearance of frost), which led to the interruption of the vegetation. Having in mind that the maize is the plant with high demands towards nitrogen fertilization, what can be seen is a positive influence of the N fertilizer in fertilization on forage yield, dry matter, proteins, and on organic matter yield is visible only with the greatest amount of the N, which can be a consequence of the difficult adoption of the mineral inputs during the lack of water inside the land.

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