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RESEARCHES OF THE INFLUENCE OF NITRATE CONTENTS ON MAIN MORPHOLOGICAL TRAITS OF MAIZE PLANTS

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ABSTRACT. Nitrogen is an important element required for plant growth and development. It is a key component in many biological compounds that play a major role in photosynthetic activity and crop yield capacity. Variation in nitrogen availability can affect plant development and productivity in maize. One of the ways of soil pollution through agricultural technology is over-fertilization and, in particular, the administration of high doses of nitrogen fertilizers. Excess of nitrogen fertilizers, as well as their empirical application, have negative effects on harvest quality. Excessive use of fertilizers with nitrogen, produces of ion nitric accumulation in the soil (temporary) and in plants, which disturbs the balance of photosynthesis, causes the appearance of necrosis and burns on leaves, severe intoxication and even death by asphyxiation phenomena and cyanosis at ruminants, children and old people. The main aim of this study was to determine the effect of different nitrogen levels and different type of fertilizers on nitrates levels in maize leaves and on morphological traits of maize plants. Field experiments were conducted in two growing seasons (2017 and 2018) with five nitrogen levels (80 kg/ha, 120 kg/ha, 160 kg/ha, 200 kg/ha and 240 kg/ha) and two type of nitrogen fertilizers (ammonium nitrate and urea).

Keywords: ammonium nitrate; urea; maize; chemical fertilizers.

INTRODUCTION

In the last decade, yield grains have been increasing. In maize, it has been associated with the increase of the nitrogen use (Hirel *et al.,* 2001), which the farmers still believe that the high level can guarantee a safety harvest (Montemurro *et al.,* 2006), and the nutrient used above is the most important in the vegetable development (Presterl *et al.,* 2002).

The nowadays, the levels of nitrogen fertilizer used in the corn crop can be involved with the aquifer

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contamination (Plăcintă, 2005) or any type of natural resource, decreasing its quality (Al-Kaisi and Yin, 2003). Also, some extra activities can help the nitrogen efficiency (Cui *et al.,* 2009), such as using a narrow row spacing, decreasing the fertilizer through increasing of recovery efficiency (Barbieri *et al.,* 2008), crop rotation and the use of organic fertilizer (Montemurro *et al.,* 2006).

Many plant species (fodder plants, spinach, carrot, cabbage, etc.) have high capacity to accumulate nitric ion, which leads to diminished qualities of these products from the nutritional point of view, in the case of excessive nitrogen doses (Davidescu and Neaţă, 1992; Lăcătusu *et al.,* 1992; Răuţă and Cârstea, 1983; Teşu and Baghinschi, 1984; Davidescu, 1980; Davidescu *et al.,* 1992; Dumitru *et al.,* 1994; Bibicu, 1997). Therefore, it is necessary to establish and quantify the impact of nitrates on soil, the environment and plants.

MATERIAL AND METHODS

For the study of nitrat contents in maize plants (trilinear hybrid Suceava M), it used a factorial combination of two factors: type of fertilizer and N rates. The experiments was placed at the Suceava Agricultural Research and Development Station, Romania, in two growing seasons (2017 and 2018), in randomized complete block design (RCBD) with randomly placed variants.

The two nitric fertilizers (ammonium nitrate and urea) were applied after the emergence of the plants, using the following variants: V_1 - unfertilized control; V_2 - N_{80}; V_3 - N_{120}; V_4 - N_{160}; V_5 - N_{200}; V_6 - N_{240}. The plot was maintained by manual work on rows and between rows. The plant samples were taken in three distinct periods: when the plants had five leaves, at flowering, and at maturing in milk. Also, the morphological descriptors to the plants, ears and kernels were made during vegetation period, after flowering.

Soil study site was a degraded chernozem with high clay content. A chemical analysis performed one month before installing the trial indicated the following soil characteristics: humus - 3,86%; clay - 27,96%; P-Al - 53,2 ppm; K-Al – 117 ppm; pH (water) - 4,88; Nt (s.u.) - 0,186%; Al - 0,35 me/100 g.

Chemical analyses in plants and soil were performed by chemical and physi-cochemical methods (Schollemberger method; Kacinscki method; colorimetric method).

RESULTS AND DISCUSSION

The impact of the two fertilizers (ammonium nitrate and urea), through nitrates content, on different morphological descriptors is presented in *Table 1*.

From the presented data (*Table 1*) it is note very significant correlations between nitrates content and some morphological data (ear height, minimum diameter of ear), when was applied ammonium nitrate. Also, there are the same significant correlations when it used urea fertilizer, but for other morphological descriptors (plant height, maximum diameter of the stem, minimum diameter of the stem, minimum diameter of ear, weight of ear/plant). For emphasize of this, we

have drawn regression lines between nitrates content and some important morphological traits.

In *Figs. 1* and *2* it is noticed very significant negative correlations between the nitrates content and the minimum diameter of the ear and significant negative correlations between the nitrates content and number of kernels/row when it apply the both fertilizers. Referring the weight ear / plant it is noticed significant positive correlations between nitrates content and weight of ear/plant when it apply ammonium nitrate and very significant negative correlations when it apply urea fertilizer (*Figs. 3* and *4*).

Table 1 - Correlation coefficients between nitrate content and morphological descriptors of the trilinear Hybrid Suceava M

Ammonium nitrate fertilizer			Urea fertilizer		
Morphological traits	**Nitrates contents**	**Signifi-cance**	**Morphological traits**	**Nitrates contents**	**Signifi-cance**
Plant height (cm)	0.344	-	Plant height (cm)	0,844	***
Ear height (cm)	0,660	***	Ear height (cm)	-0.195	-
Maximum diameter of stem (mm)	0.395	-	Maximum diameter of stem (mm)	0.800	***
Minimum diameter of stem (mm)	-0.768	000	Minimum diameter of stem (mm)	-0.715	000
Total numbers of leaves	-0.01	-	Total numbers of leaves	-0.01	-
Leaf length (cm)	0.155	-	Leaf length (cm)	0.140	-
Leaf width (cm)	-0.195	-	Leaf width (cm)	-0.195	-
Ear length (cm)	-0.510	0	Ear length (cm)	-0,105	-
Maximum diameter of ear (mm)	-0.329	-	Maximum diameter of ear (mm)	-0,384	-
Minimum diameter of ear (mm)	-0.923	000	Minimum diameter of ear (mm)	-0,826	000
Number of kernels/row	-0.574	00	Number of kernels/row	-0,503	0
Kernel length (mm)	0.290		Kernel length (mm)	0,537	**
Kernel width (mm)	-0.231		Kernel width (mm)	0,572	**
Kernel thickness (mm)	-0.397		Kernel thickness (mm)	-0,059	-
Weight of grains/ear (g)	0.021		Weight of grains/ear (g)	-0,352	-
Weight of ear/plant (g)	0.590	**	Weight of ear/plant (g)	-0,982	000
Moisture content of kernels (%)	-0.229	-	Moisture content of kernels (%)	0,071	-
Weight of sample (five ears) (g)	-0.509	0	Weight of sample (five ears) (g)	0,530	**
Sample yield (%)	0.516	0	Sample yield (%)	0,040	-

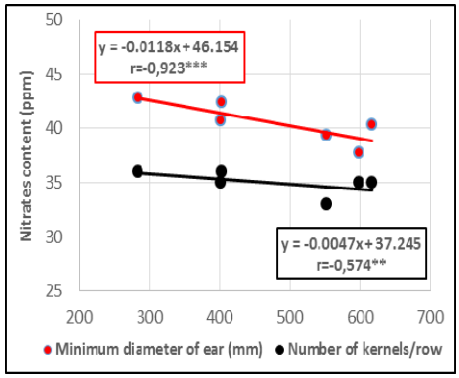

Figure 1 - Regression lines for the correlation between the nitrates content and morphological traits (minimum diameter of ear and number of kernels/row) when it used ammonium nitrate

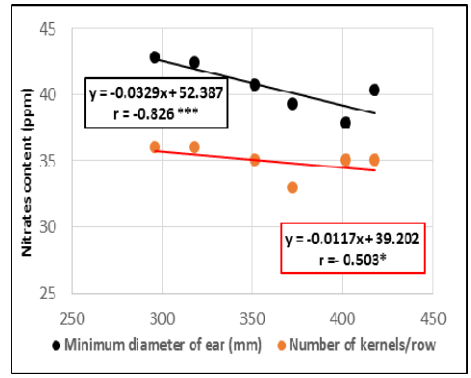

Figure 2 - Regression lines for the correlation between the nitrates content and morphological traits (minimum diameter of ear and number of kernels/row) when it used urea fertilizer

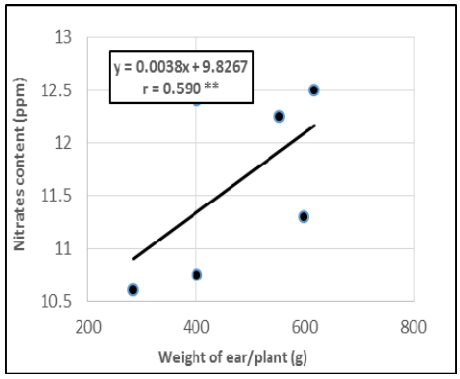

Figure 3 - Regression line for the correlation between the nitrates content and weight of ear/plant when it used ammonium nitrate

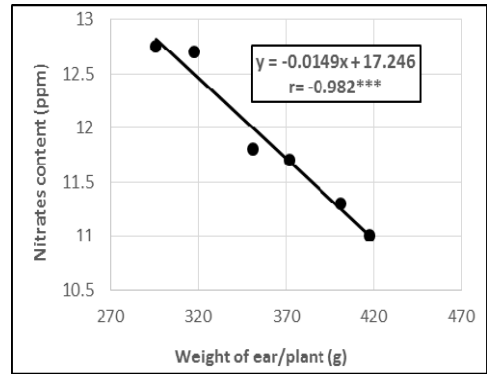

Figure 4 - Regression line for the correlation between the nitrates content and weight of ear/plant when it used urea fertilizer

Referring to nitrates content on maize leaves, the big values of this chemical compound are observed at high quantities of fertilizers with nitrogen. The biggest values are registered in the first stage. Also, is notice a big difference between that two types of fertilizers. In case of urea, the level of nitrates is smaller than in ammonium nitrate. In *Fig. 5* is observed that the nitrates content is highest in first development stage when it is used ammonium nitrate.

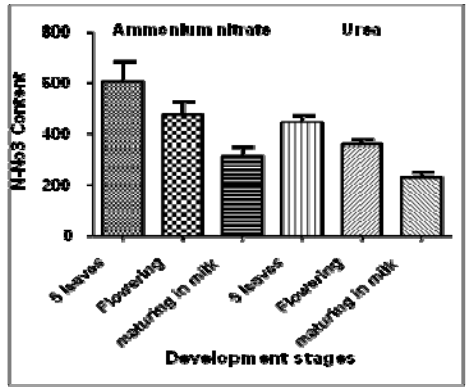

Figure 5 - The nitrate content in three development stages of plants depending on the fertilizer used

CONCLUSIONS

It was concluded from this study, the type of fertilizer have a big influence on morphological descriptors.

Regarding the presence of relationship between nitrates content from plants and different morphological descriptors, significant correlations were observed between nitrates content and some morphological descriptors at both type of fertilizers.

Referring to presence of nitrates in plants it was concluded that the level of nitrates is biggest when plants have five leaves and it is apply the ammonium nitrate fertilizer.

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