THE INFLUENCE OF GRAMOXONE HERBICIDE ON THE CONTENT OF THE PHOTOSYNTHETIC PIGMENTS IN *ZEA MAYS*

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Key words: Gramoxone, *Zea mays*, chlorophyll a, chlorophyll b, carotenes

Abstract: The active substance of Gramoxone herbicide is interacting with plant's photosynthetic systems, playing the role of final acceptor of the photosynthetic electrons. Except this known mode of action, it has been also observed the inhibitory action on the protoporphyrinogen oxidase – essential enzyme for chlorophylls biosynthesis, and also the decrease of photosynthetic pigment's concentration in some spontaneous plants. Based on these prerequisites, the present study demonstrates the decrease of the photosynthetic pigment's content in *Zea mays* in the presence of Gramoxone.

INTRODUCTION

Gramoxone has as active substance the methyl-viologen. There were previously studied the effects of the methyl-viologen and other two viologens (carbamoylmethyl-viologen and cyanomethyl-viologen) on the protoporphyrinogen oxidase - essential enzyme for the chlorophylls biosynthesis [4]. It was also studied the influence of methyl-viologen on the photosynthetic pigment's level in two spontaneous plants, *Alliaria petiolata* and *Chenopodium album* [5]. In the present work, we considered the methyl-viologen's effect on chlorophyll a and b and on carotenes concentrations in a cultivated plant - *Zea mays*.

MATERIAL AND METHOD

The Gramoxone herbicide, produced by Zeneca Company, England, contains methyl-viologen (1,1'-dimethyl-4,4'-bipyridilium dichloride) 200 g/l.

The herbicide was applied on the mature corn leaf using the disc-leaf method [2, 6]. The content of the photosynthetic pigments was measured using the spectrophotometric method [1, 6].

The obtained data are the results of the average of 5 sample determinations and were statistically analysed using the Student Test [7].

RESULTS AND DISCUSSIONS

We noticed the decrease of the chlorophyll a content under Gramoxone treatment, especially for the last two herbicide concentrations, as it is presented in the figure 1:

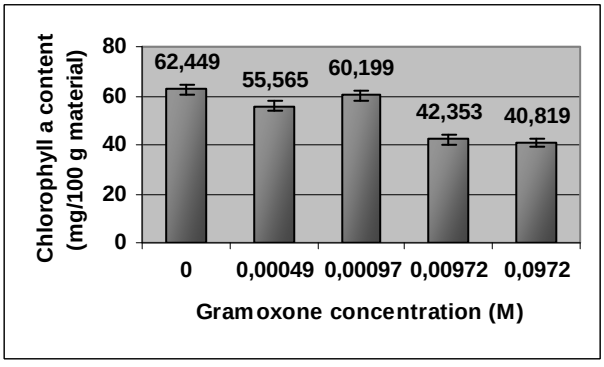

Fig.1. The influence of different Gramoxone concentrations on chlorophyll a content (mg / 100 g vegetal material)

Concerning the chlorophyll b content, there is a decrease after Gramoxone treatment, which is not proportionally with the variation of herbicide's concentration (fig. 2), same as in the case of chlorophyll a:

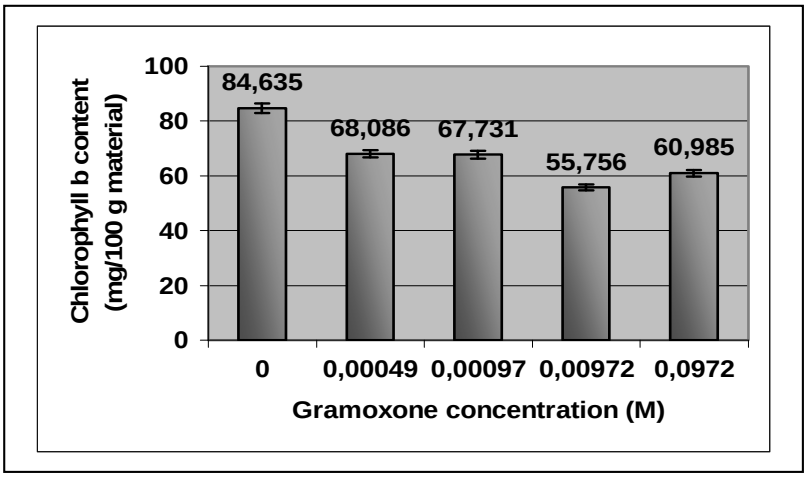

Fig.2. The influence of different Gramoxone concentrations on chlorophyll b content (mg / 100 g vegetal material)

In the case of carotenes, also the content's decrease is not proportionally with Gramoxone concentration (fig. 3):

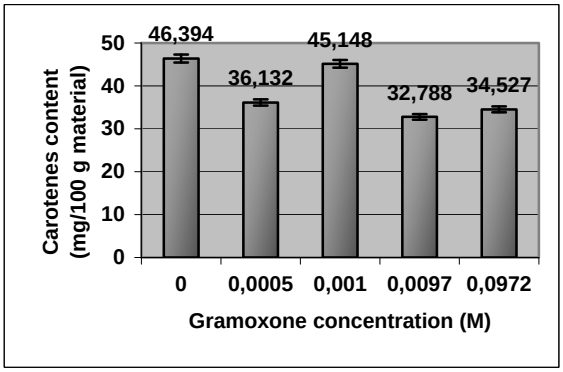

Fig.3. The influence of different Gramoxone concentrations on carotenes content (mg / 100 g vegetal material)

Both chlorophylls content, but also carotenes content, decreases when the herbicide is applied. The most important decrease of chlorophyll a concentration, comparing with the untreated sample, is for the biggest Gramoxone's concentration (0.0972 M); for the other two pigments, the decrease is strong significant statistically for 0.00972 M Gramoxone.

The table 1 shows the ratio between chlorophyll a and b concentrations and the ratio $C_c/(C_a+C_b)$, for different Gramoxone concentrations:

Table 1. The ratio of assimilatory pigments concentrations in *Zea mays*, for different Gramoxone concentrations

Gramoxone concentration (M)	C_a/C_b	$C_c/(C_a+C_b)$
0 (martor)	0.7372	0.3139
0.000486	0.8131	0.2926
0.000972	0.8878	0.3531
0.00972	0.9266	0.3713
0.0972	0.6695	0.3392

In the case of *Zea mays* plants, same as *Alliaria petiolata*, previously studied [5], Gramoxone has inhibitory actions on assimilatory pigments content. For the most important herbicide concentration, the chlorophyll a content is about 65% comparing with the untreated plant, the chlorophyll b content is about 72% and carotene concentration is about 74%.

Our results are correlated with others author's, which founded the decrease of chlorophyll content in corn leaves disc's [3].

All this behaviour might be explained by the disorganizations of chloroplast's membranes and by the chlorophyll degradations, produced by the oxidative stress induced in plants by the methyl-viologen.

CONCLUSIONS

The Gramoxone treatment induces the decrease of assimilatory pigments content in *Zea mays* leaves for any concentration.

The secondary pigments (chlorophyll b, carotenes) are diminished less than chlorophyll a – the most important pigment that conditions the structures and functions of the two photosynthetic systems.

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