

Effect of Pendimethalin and Oxyfluorfen Herbicides on Relative Water Content in Leaves of *Zea mays* l. Seedlings.

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ABSTRACT

The aim of this study was to ascertain the effect of two herbicides on the relative water content in three weeks old *Zea mays* seedling. Foliar application of the two herbicides resulted in obvious reductions of the relative water content. With oxyfluorfen, percentage reductions compared to control amounted to 9%, 11%, 7%, 11% and 14% after 12, 24, 36, 48 and 60 h respectively, whereas with Pendimethalin percentage diminishments were 8%, 10%, 12%, 15% and 20% after 12, 24, 36, 48 and 60 h respectively.

INTRODUCTION

Many reports have shown that herbicide application can strongly influence some of the physiological and biochemical processes of target and non-target crops. Dear et al., (1995) have observed decline in water use and stomatal conductance in *Trifolium subterraneum* after 10-20 days following spraying with broad leaf herbicides. Similar conclusions were drawn by Eart and Ferrel, (2004) who reported that three herbicides caused reductions in stomatal conductance and water use in *Cyperus esculentus*. Also, Bigot et al., (2007) showed that the herbicide flumioxazin badly affected the non-target plant *Vitis vinifera* in lowering stomatal conductance. Five herbicides were reported to decrease the turgor pressure in cotton and maize seedlings (El Tahir, 2010). Gorske and Hopen (1978) showed that the two herbicides nitrofen and oxyfluorfen lowered the water potential in two varieties of cabbage by about two bars.

The objective of this study focuses on spraying oxyfluorfen and Pendimethalin (10 ppm each) on leaves of three weeks old *Zea mays* seedlings and determining the relative water content of the hydrated and herbicide stressed leaves.

MATERIALS AND METHODS

Plant Culture:

Grains of *Zea mays* L. variety Mugtama 45 were surface sterilized with 1% hydrogen peroxide, rinsed several times with distilled water and germinated in deep plastic trays containing sand and clay (1:1), and watered every other day. Seedlings of comparable size aged three weeks were used in this study. Two herbicides, oxyfluorfen (goal), and Pendimethalin (stomp) were foliar sprayed to *Zea mays* seedlings, and the relative water content was measured every 12 hours of hydrated and herbicide stressed seedlings.

Measurement of the Relative Water Content:

Measurement of this parameter is performed on three weeks old leaves. Detached leaves were weighed (Fresh mass, FM). In order to obtain the turgid mass (TM) leaves were floated in distilled water inside a closed Petri dish. During the imbibitions period, leaf samples were weighed periodically after gently wiping the water from the leaf surface with tissue paper. The Petri dishes were maintained under dim light and under naturally fluctuating temperature conditions in the

laboratory. At the end of the imbibition period, leaf samples were placed in a pre-heated oven at 80°C for 48h. in order to obtain dry mass (DM). The percentage relative water content is obtained using the following formula.

$$\text{Relative Water Content \%} = \frac{\text{FM} - \text{DM}}{\text{TM} - \text{DM}} \times 100$$

Herbicides used in this study:

- 1-Oxyfluorfen (C₅ H₁₁ Cl F₃ NO₄"goal") is a diphenyl-ether used to control certain annual broad leaf and grassy weeds in vegetables, fruit, cotton and ornamentals.
- 2-Pendimethalin (C₁₃ H₁₉ N₃ O₄"stomp") is a selective herbicide used to control broad leaf weeds and grassy weed species in a number of crop and non crop areas, and on residential lawns and ornamentals.

RESULTS AND DISCUSSION

Scanty information are available concerning the influence of herbicides on relative water content, but the depressive effects of many herbicides on other water use parameters were reported. Physiological parameters are sensitive and provide information of the toxicity of herbicides in plants. In this study, the impact of herbicide application on plant water use was evaluated by the relative water content measurements. The effectiveness of the two herbicides, expressed in terms of relative water content is summarized in Oxyfluorfen spraying provoked reductions of relative water content compared to controls by 9%, 11% and 14% after 12, 24, 36, 48 and 60 h respectively (Fig. 1), whereas percentage reductions of the parameter triggered by pendimethalin were 8%, 10%, 12%, 15% and 20% after 12, 24, 36, 48 and 60 h respectively (Fig. 2). Results presented in this study are comparable with others showing the drastic effects of herbicides on water use parameters (Lee and Mudge, 2003; Dear, et al., 1995; Eart and Ferrel, 2004; Bigot. et al., 2007 and El Tahir 2010).

Relative water content is probably the most appropriate measure of plant water status in terms of the physiological consequence of cellular water deficit. The growth of plants is an expression of all enlargement brought about by the action of water, and that many of the metabolic reactions of plants are conditioned by the degree of hydration of certain reactants or enzymes.

Time (h)

Fig. 1. Relative water content during imbibition periods for hydrated and herbicide stressed leaves of maize sprayed with goal (10 ppm). Vertical bars indicate \pm SD, (n=3).

Time (h)

Fig. 2. Relative water content during imbibition periods for hydrated and herbicide stressed leaves of maize sprayed with stomp (10 ppm). Vertical bars indicate \pm SD, (n=3).

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تأثير المبيدات العشبية بنديميثالين و اوكسيفلورفين على محتوى الماء النسبي في أوراق بادرات الذرة الشامية. سامية محمد علي وميرغني عبدالرحمن وصفي
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تهدف هذه الدراسة لمعرفة تأثير مبيدات عشبية على محتوى الماء النسبي على بادرات الذرة الشامية. رش المبيدات على البادرات احدث انخفاضاً واضحاً على محتوى الماء النسبي. فكان الانخفاض المنوي عند رش البادرات بمبيد اوكسيفلورين ٩%، ١١%، ٧%، ١١% و ١٤% بعد ١٢، ٢٤، ٣٦، ٤٨ و ٦٠ ساعة بالتتالي بينما تسبب مبيد بنديميثالين بانخفاض محتوى الماء النسبي ب ٨%، ١٠%، ١٢%، ١٥% و ٢٠% بعد ١٢، ٢٤، ٣٦، ٤٨، و ٦٠ ساعة بالتتالي.