

## Effect of The herbicide Pendimethalin on The Chlorophyll Content in *Zea mays* L. and *Gossypium hirsutum* L. Seedlings

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### ABSTRACT

Foliar application of pendimethalin herbicide (5 ppm) to three weeks old seedlings of *Zea mays* L. and *Gossypium hirsutum* L. resulted in a decreasing trend of chlorophylls a and b in both seedlings compared to controls. Chlorophyll b exceeded chlorophyll a in maize, whereas in cotton a reverse manner was observed. The chlorophyll ratio a/b in cotton surpassed the chlorophyll ratio in maize.

### INTRODUCTION

Modern herbicides are often synthetic mimics of natural plant hormones which interfere with growth of the target plants. They can act on pathways or processes crucial to plants in an inhibitory or stimulatory way depending on the dose of the herbicide. They are extremely important in agriculture, but, under certain circumstances they may impair and negatively interfere in some physiological and biochemical processes of non-target plants which are meant to protect from unwanted weeds and other invasive plants (Mahkavi et al., 2014).

The vital processes which are drastically affected by different herbicides in non-target plants range from photosynthesis, pigment content, water use parameters (turgor pressure, stomatal conductance relative water content, water potential etc.), and some enzymes such as nitrate reductases and the amylases. Khan et al., (2006) have reported that the chlorophyll content decreased consistently with increased rates of two herbicides in chickpeas, together with nitrogenase activity and seed production. Also, Koley et al., (1993) have demonstrated that two chlorophenoxy herbicides (2,4-D and 2, 4, 5-T) reduced the chlorophyll content in sunflower (*Helianthus annuus* L.).

The objective of this study focuses on the influence of foliar applied pendimethalin (5 ppm) to three weeks old seedlings of maize and cotton and then assay the chlorophylls a and b together with the chlorophyll ratio a/b.

### MATERIALS AND METHODS

#### Plant Culture:

Grains of *Zea mays* L. (maize), variety Mugtama 45 and seeds of *Gossypium hirsutum* L. (cotton), variety Barakat 90 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. Pendimethalin (stomp) was foliar sprayed to seedlings and the chlorophylls (a and b) were assayed after three days.

#### Herbicide used in this study:

Pendimethalin (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.

#### Measurement of chlorophyll content:

The method used was that described by Strain and Svec (1966). One gram of fresh leaves is ground with 40 ml of acetone solution (80%) in a clean mortar. The green liquid is carefully transferred to Buchner funnel with Whatman filter paper No. 1. The residues is further extracted twice with acetone solution, and the filtrates were collected and made with acetone solution to 100 ml. The absorbance of the green solution is read at 645 nm and 663 nm against a solvent blank.

#### Calculation:

The chlorophyll content is calculated as follows:

Chlorophyll a mg/ml =  $11.46 \times A_{663} - 2.16 \times A_{645}$

Chlorophyll b mg/ml =  $20.97 \times A_{645} - 3.9 \times A_{663}$ .

### RESULTS & DISCUSSION

Results presented in Fig. 1 show the effect of foliar application of stomp (5 ppm) on chlorophylls a and b in leaves of maize seedlings. The herbicide triggered obvious decreased the parameters with aggravation of the decline in chlorophyll b. It is worth mentioning that chlorophyll b content excelled chlorophyll a. Foliar spray of stomp also diminished the chlorophylls a and b in cotton leaves (Fig. 2), but content of chlorophyll a outclassed chlorophyll b. Decline of the chlorophyll, provoked by the herbicide stomp in this study are comparable with other reports. Behran et al., (1979) have shown that chlorophyll content decreased from 345 to 138 mg/m<sup>2</sup> when soybean plants were treated with the herbicide trifluralin. Hana et al., (2015), also showed that the levels of chlorophylls in wheat plants subjected to two herbicides (Sekator and Zcom) were significantly lower compared to untreated plants.

A leaf chlorophyll content is strongly affected by numerous external factors. Chlorophylls of different forms play an important role as a part of the photosynthetic apparatus of all phototrophic organisms. Higher plants contain chlorophyll a, the major yellow green pigment and chlorophyll b, the blue-green pigment in different ratios. Research reveal that chlorophyll content changes correlate with water stress and herbicides (Ferus and Arkosiova, 2001). Leaf chlorophyll content varies within wide limits of fresh matter. According to the majority of investigations the ratio between chlorophyll a and b is approximately 3:1. This ratio varies greatly as a function of plant growth and development, the cultivar of plant in question, and a

number of other factors such as light intensity, water availability, mineral nutrition and herbicide stress (Bojorvic and Stojanovic, 2005). Samuel and Bose (1987) reported that in *Chlorella* sp. Chlorophyll a synthesis appeared to be inhibited more than chlorophyll b when treated with pyridazinone herbicide, and this results in lowering the a/b ratio. Dos Santos *et al.*,

(1999) reported that different herbicides produce different concentrations of chlorophyll a and b, and consequently the a/b chlorophyll ratio vary greatly among plants. The chlorophyll ratio decreased in olive plants treated with five herbicides (Romera *et al.*, 1988).

In this study, the a/b chlorophyll ratio increased in cotton and decreased in maize.

**Fig. 1.** Effect of foliar application of stomp on chlorophyll content in leaves of *Zea mays* seedlings. Vertical bars indicate  $\pm$  SD, (n=3).

**Fig. 2.** Effect of foliar application of stomp on chlorophyll content in leaves of *Gossypium hirsutum* seedlings. Vertical bars indicate  $\pm$  SD, (n=3).

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**تأثير المبيد العشبي بنديميثالين على محتوى الكلوروفيل في بادرات الذرة الشامية والقطن.  
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رش المبيد العشبي بنديميثالين بتركيز ٥ جزء في المليون على بادرات الذرة الشامية والقطن بعمر ثلاثة أسابيع تسبب في انخفاض محتوى الكلوروفيل بشقيه أ و ب في كلا النباتين. محتوى الكلوروفيل ب كان الأغلب في الذرة الشامية بينما حدث العكس في القطن. نسبة الكلوروفيل أ/ب كانت أكبر في القطن مقارنة بالذرة الشامية.