

**DEGRADATION OF ^{14}C -GLYPHOSATE IN APPLE PLANTATIONS
IN AGRO-TECHNIQUES CONDITIONS OF WESTERN ROMANIA**

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Abstract

This study has proposed the identification of glyphosate degradation capacity in trees plantation in the scientific didactic resort of Banat's University of Agricultural Sciences and Veterinary Medicine Timisoara, Romania compared with experiments realized on the same soil in laboratory conditions. Laboratory analysis of glyphosate residues in soil were made using TRIATHLER Scientilator liquid.

Radioactivity brought by the C14 glyphosate standard to fosfonometil group was 37kBq for each soil. Evolution of glyphosate mineralization in soil was highlighted by capturing $^{14}\text{CO}_2$ evolved following the action of soil microorganisms on herbicide, in 0.2 M NaOH solution at various time intervals.

Results indicate that the percentage of CO_2 accumulated after glyphosate biodegradation under the action of microorganisms is higher in the laboratory experiment compared with the results from experimental field. CO_2 fraction accumulated after 50 days is 73.42% in the laboratory experiment versus 28.02% for samples exposed in the experimental field

Key words: glyphosate, apple plantation, microorganisms, degradation .

1.INTRODUCTION

Glyphosate is a broad-spectrum, non-selective systemic herbicide. It is useful on essentially all annual and perennial plants including grasses, sedges, broad-leaved weeds and woody plants [1]. It can be used on non-cropland and among a great variety of crops. Glyphosate is usually formulated as an isopropylamine salt [6] . Glyphosate is highly adsorbed on most soils especially those with high organic content. The compound is so strongly attracted to the soil that little is expected to leach from the applied area. Microbes are primarily responsible for the breakdown of the product. The time it takes for half of the product to break down ranges from 1 to 174 days [4]. Because glyphosate is so tightly bound to the soil, little is transferred by rain or irrigation water. One estimate showed less than two percent of the applied chemical lost to runoff. Glyphosate is readily absorbed by foliage and other shoot portions of plants. Once absorbed into the plant, glyphosate readily and extensively translocates symplastically. Once in the phloem, it generally follows the source-sink photosynthate movement pattern in the plant and accumulates in areas of active growth (meristems) [3]. In fruit plantations weed control; glyphosate is used as a way of chemical weed combat or in combination with other agro-techniques treatments (manual or mechanical breeding, interval was grassing with a mixture of gramineae) [5].

2.MATERIALS AND METHOD

The experiment was made in the teaching experimental resort of USAMVB Timisoara, in the fruit trees plantation (Figure 1). The experiment was conducted in parallel also in laboratory conditions (Figure 2). Experience regarding the effects of glyphosate herbicide in trees plantation of

was done in March to Pioneer variety, experimental results obtained are interpreted depending on external factors that influence the biodegradation process of glyphosate. Laboratory analyses of glyphosate residues in soil were made using TRIATHLER Liquid Scintillation Counter (*Figure 2*).

The soil was treated under identical conditions, both field and laboratory was equipped with glyphosate and cold initial concentration equal with applied field concentration and estimated at 1.5 ppm. Radioactivity brought by the C14 glyphosate standard to phosphonomethyl group was 37kBq for each soil. Evolution of glyphosate mineralization in soil was highlighted by capturing $^{14}\text{CO}_2$ evolved following the action of soil microorganisms on herbicide, in 0.2 M NaOH solution at various time intervals. The solution taken was mixed with 5 ml scintillate liquid (Quicksafe A) in a 20 ml vial and read the number of disintegration with Liquid Scintillation Counter. After each sampling was replaced the vial with fresh 0.2 M NaOH solution. The experiment took place over 50 days, the amount of $^{14}\text{CO}_2$ accumulated during the experiment is calculated by summing the amount of CO_2 released from each sample. [2]



*Figure 1. Persistence and effectiveness of glyphosate study
against weeds in apple plantations*

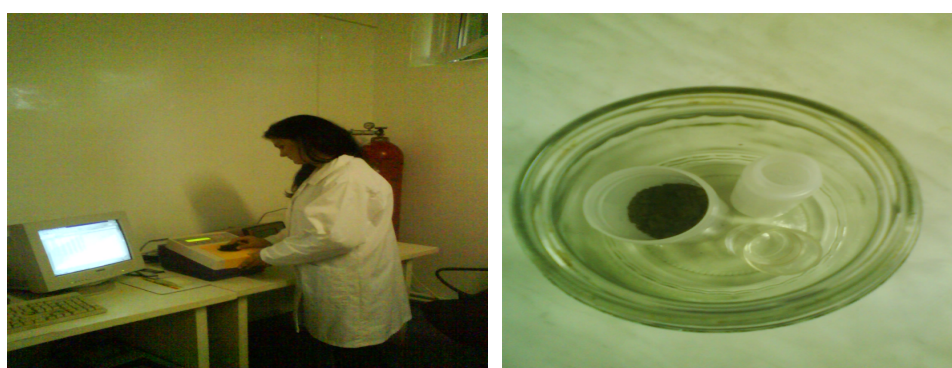


Figure 2. Study of biodegradation capacity of glyphosate in the laboratory

3. RESULTS AND DISCUSSIONS

Mineralization curves obtained which render the amount of $^{14}\text{CO}_2$ accumulated during the experiment (expressed as a percentage of initial radioactivities) and degradation rate in the laboratory and experimental field are given in *Figure 5 and 6*.

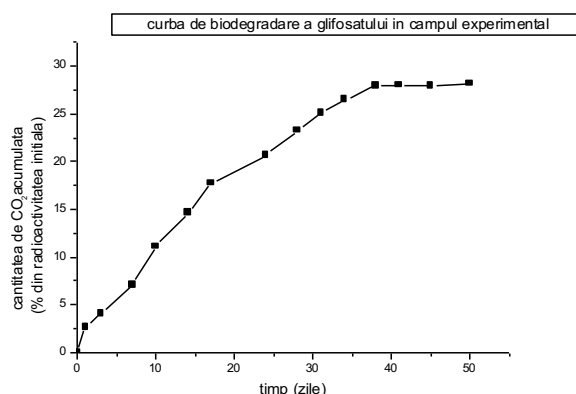


Figure 4. Glyphosate biodegradation curve in fruits trees experimental field.

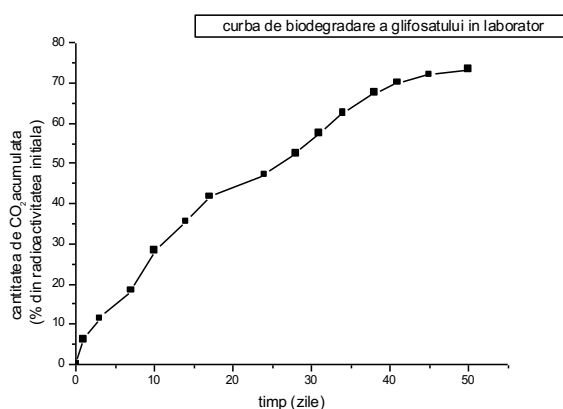


Figure 4. Glyphosate biodegradation curve in laboratory conditions.

Study of biodegradation capacity in parallel, in the experimental field and laboratory, indicates that the rate of CO_2 accumulated after glyphosate biodegradation under the action of microorganisms is higher in the experiment realized in the laboratory compared with the experiment in the experimental field.

CO_2 fraction accumulated after 50 days, in the experiment realized in the laboratory is 73.42% versus 28.02% for samples exposed in the experimental field. Weather conditions, especially temperature variations between day and night, influences the soil microorganisms activity which affect biodegraded glyphosate percentage.

CONCLUSIONS

- The CO₂ rate accumulated after glyphosate biodegradation under the microorganisms action is higher in laboratory conditions compared with the experimental field conditions.
- Weather conditions, especially temperature variations between day and night, influences the microorganisms activity and percentage of biodegraded glyphosate.

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