# PRELIMINARY RESEARCH CONCERNING THE EFFECS OF INSECTICIDE TREATMENTS ON SOME SOIL PARAMETERS IN TRUCK FARMING

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***Abstract:*** *Pesticides constitute the group of chemical products with most synthesis chemical substances. They are meant to prevent or to control the development of any plant or animal organism considered unwanted in any type of biocoenosis. Treating plants and soil with insecticides is the main source of contamination of the environment with these substances and soil is the main reservoir of residues due to the holding capacity of its organic and mineral components and to the ability or turning these compounds into other derivatives as a result of metabolic processes induced by both the micro- and macro-fauna in the soil. In this context, in this paper the authors aimed at presenting results concerning the effect of insecticide application on some soil parameters. While research in the field worldwide are being carried out, at national level they are rather scarce or they simply lack. Our research was carried out in 2010 at the Didactic Station of the Banat University of Agricultural Science and Veterinary Medicine in Timişoara, using as host-plant onion; the trial was a mono-factorial and on randomised blocks. In order to establish the physical and chemical composition of the soil before and after treatment we analysed soil samples from the surface horizon. Results show the degree of impact of insecticides on some soil parameters. These results are within admitted limits from the point of view of environmental pollution. Knowing the effects of insecticide application is essential for soil, plant, anima, and human protection. Research is original and they contribute to the study of environmental pollution and protection.*

**Key words:** *insecticides, soil, soil pollution, truck farming*

## INTRODUCTION

Soil is the layer on which live and develop plants and animals; therefore, it is soil that makes human existence possible. There are, in the soil, complex biochemical processes that result in complex changes of different chemical compounds.

Pesticides are applied by dusting or spraying on crops; they set on plants and on soil surface. A certain amount of the preparation (about 30%) that covers plants is swept by the wind or washed out by the rain onto the soil surface. Besides that, some pesticides are applied in plant protection directly on the soil (NIKONOROW 1981).

The presence of pesticides in the soil depends on the frequency and methods sued in controlling soil pests, on the intensity of plant protection treatments, on plant structure, on plant size, etc.

No matter the way pesticides get into the soil, they are subjected to such processes as oxidation, root absorption, chemical and biological degradation, as well as removal due to water movement or, in some cases, to wind erosion (NIKONOROW 1981).

The behaviour of the pesticides applied depends on a series of interactions and relationships in which the complex exchange with the soil hold a central position. Pesticide adherence to the soil is determined by Van der Waals forces, hydrogen links, hydrophobic links, ion-dipole dipole-dipole interaction, chemical adsorption, and ion exchange. Parts of the pesticides that reach the soil are biodegraded, taken over by underground water, or absorbed by the plant root system. The fraction that falls on the soil can be partly vaporized, but most often it is solubilised by water from rainfall and taken away at soil surface or deep in the soil, constituting an important element in environmental pollution thus affecting the microbial flora in the soil (POPA *et. al*. 1986).

The effects of pesticides are *immediate* effects due to the highly acute toxicity and *long-term* effects due to the chronic toxicity, to the persistence and disturbance of some structures and functions of the agro-ecosystem.

Only some of these effects can be considered pollution phenomena of agro-alimentary produce, of the flora, air, water, and soil.

## MATERIAL AND METHOD

Research concerning the effects of pesticide treatments on some soil parameters was carried out in 2010 on a trial field of the Didactic Station in Timişoara cultivated with onion.

***Soil sampling***. In order to analyse in the laboratory the soil reaction (pH) as well as soil supply in nitrogen, phosphorus, and potassium, we sampled the soil before insecticide application with a special probe. The soil samples were then put into plastic bags and labelled.

We sampled the soil 12 times: after removing the superficial layer of the soil over 3-5 cm, we sampled each time about 100 g of soil in the subjacent area 0-10 cm deep. The soil samples were carried to the laboratory as quick as possible.

*Materials used:* probe, plastic bags, labels.

***Present acidity*** (or *dissociated acidity*), given by the hydrogen ion concentration in the soil solution after the dissociation of different acids, was determined by measuring the active concentration of hydrogen ions in the soil solution potentiometrically (using a Mettler Delta 340 pH-meter).

*Materials used*: soil sample, Mettler Delta 340 pH-meter.

***Determining total nitrogen content*** in the soil was done using the Kjeldahl method.

*Materials used*: soil (5 g), Kjeldahl vial, 10 g catalytic mixture (potassium sulphate + copper sulphate 10:1), 25 ml concentrated sulphuric acid, mineralisation oven, 25 ml boric acid 4%, Erlenmayer vial of 250 ml, sodium hydroxide 37%, Kjeldhal distillation equipment, titrometer.

***Determining phosphorus and potassium*** in the soil was done using the Egner-Rhiem-Domingo method.

*Materials used*: 5 g of dry, ground soil, stirring vial, 100 ml solution of ammonia acetate, distilled water (30 ml), graded balloon, 4 ml molybdenum reactive with photo-rex reactive, 2 ml of stanium chloride, spectrophotocolorimeter, and atomic absorption spectrophotometer

Pesticides were applied on the soil with a manual pump. The solutions were prepared at the beginning of the application. We sued a spraying rate of 600 ml water. The amount of insecticide used to treat each variant was as follows:

- SINORATOX 35 EC (*Dimetoat*, application concentration 0.15%) – 0.9 ml;
- ACTARA 25 WG (*Thiametoxam*, application concentration 0.02%) – 0.12 g;
- DECIS 2.5 EC (*Deltametrin*, application concentration 0.05%) – 0.3 ml;
- FASTER 10 EC (*Cipermetrin*, application concentration 0.03%) – 0.18 ml.

To avoid overlapping of combined effects of two different insecticides, we did not take into account the two rows bordering the plots.

Twenty-four hours after insecticide application, we sampled the soil in each variant treated to carry out laboratory analyses concerning soil reaction (pH) as well as soil supply in nitrogen, phosphorus, and potassium. Sampling the soil was done with a special probe. Soil samples were then put into plastic bags and labelled.

We sampled the soil 12 times: after removing the superficial layer of the soil over 3-5 cm, we sampled each time about 100 g of soil in the subjacent area 0-10 cm deep. The soil samples were carried to the laboratory as quick as possible. To determine soil reaction and soil supply in nitrogen, phosphorus, and potassium, the methods and materials we sued were the same as before insecticide application.

## RESULTS AND DISCUSSION

Using pesticides created numerous problems, thus contributing to environmental pollution. Laboratory analyses pointed out the effects of insecticides on some soil parameters and the degree of environmental pollution. Soil samples before insecticide application and 24 hours after insecticide application were analysed in the laboratory. We monitored the effect of the insecticides SINORATOX 35 EC (Dimetoat, application concentration 0.15%), ACTARA 25 WG (Thiametoxam, application concentration 0.02%), DECIS 2.5 EC (Deltametrin, application concentration 0.05%), and FASTER 10 EC (*Cipermetrin*, application concentration 0.03%) on the following soil parameters: soil reaction (pH), soil supply in total nitrogen, phosphorus, and potassium.

Results obtained in the year 2010 are presented in synthesis in Tables 1, 2, 3, and 4.

*Table 1.*

Effect of Dimethoate on soil reaction (pH), total nitrogen, phosphorus, and potassium content in the soil

| Soil parameters | Values before insecticide application | Values after insecticide application |
|---|---|---|
| Soil reaction (pH) | 7.18 | 6.65 |
| $N_{total}$ (%) | 0.191 | 0.285 |
| P (ppm) | 18.19 | 28.50 |
| K (ppm) | 177 | 179 |

The graphic representation of these results is the following:

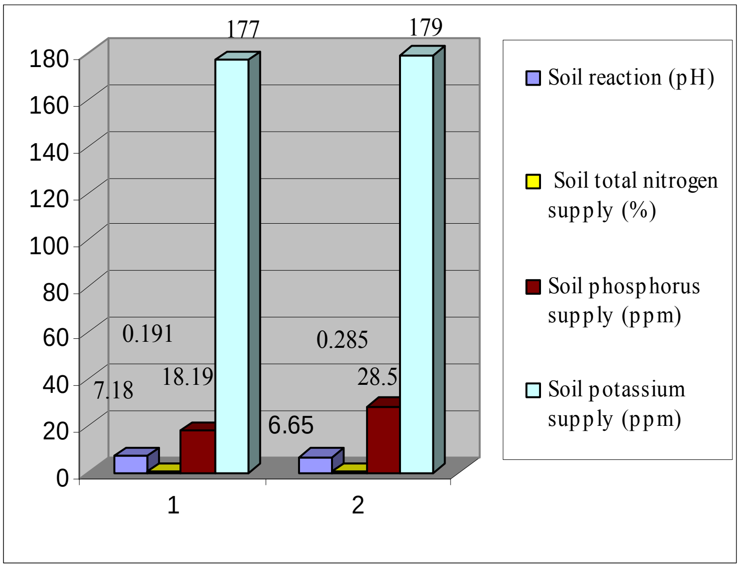


Figure 1. Effect of Dimethoate on soil reaction (pH), total nitrogen, phosphorus, and potassium content in the soil

1- Values before insecticide application; 2 - Values after insecticide application

*Table 2.*

Effect of Thyamethoxam on soil reaction (pH), total nitrogen, phosphorus, and potassium content in the soil

| Soil parameters | Values before insecticide application | Values after insecticide application |
|---|---|---|
| Soil reaction (pH) | 7.15 | 6.68 |
| $N_{total}$ (%) | 0.188 | 0.295 |
| P (ppm) | 18.21 | 28.10 |
| K (ppm) | 175 | 183 |

The graphic representation of these results is the following:

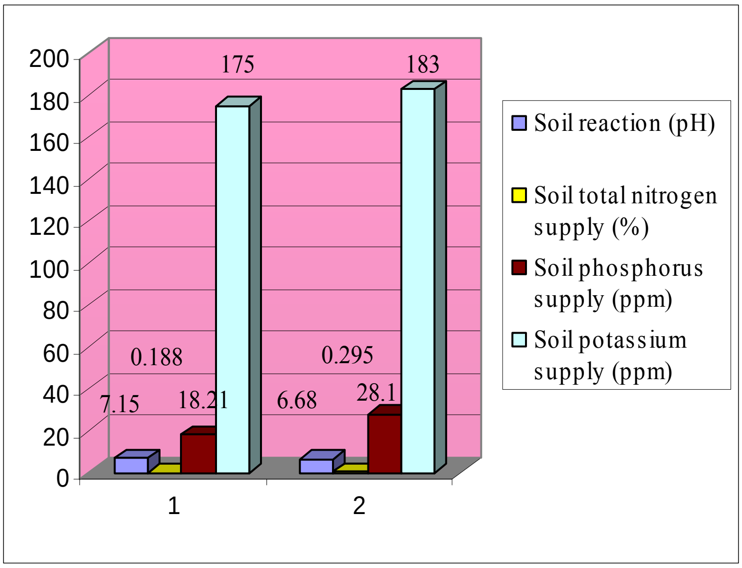


Figure 2. Effect of Thyamethoxam on soil reaction (pH), total nitrogen, phosphorus, and potassium content in the soil

1- Values before insecticide application; 2 - Values after insecticide application

*Table 3.*

Effect of Deltamethrin on soil reaction (pH), total nitrogen, phosphorus, and potassium content in the soil

| Soil parameters | Values before insecticide application | Values after insecticide application |
|---|---|---|
| Soil reaction (pH) | 7.20 | 6.64 |
| $N_{total}$ (%) | 0.192 | 0.289 |
| P (ppm) | 18.17 | 28.30 |
| K (ppm) | 178 | 182 |

The graphic representation of these results is the following:

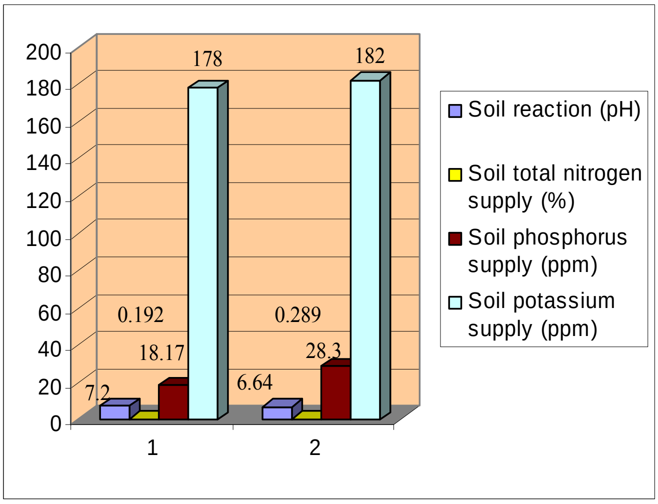


Figure 3. Effect of Deltamethrin on soil reaction (pH), total nitrogen, phosphorus, and potassium content in the soil
1 - Values before insecticide application; 2 - Values after insecticide application

The graphic representation of these results is the following:

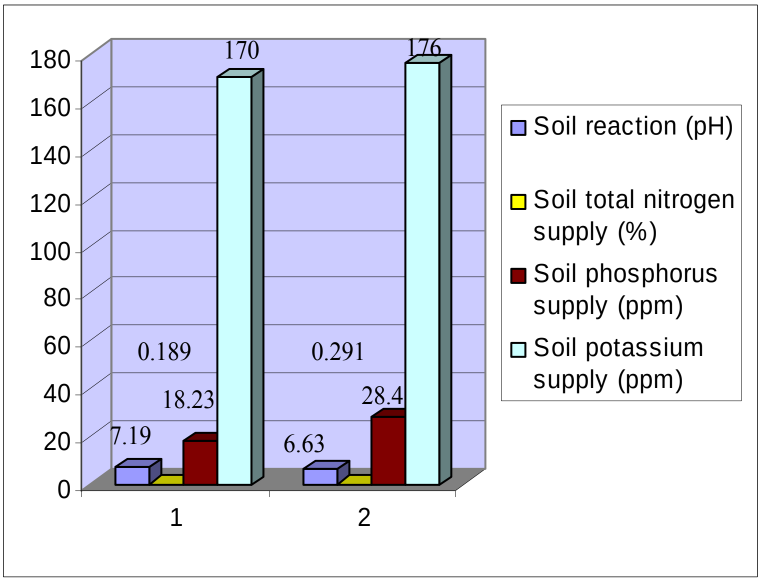


Figure 4. Effect of Cypermethrin on soil reaction (pH), total nitrogen, phosphorus, and potassium content in the soil
1 - Values before insecticide application; 2 - Values after insecticide application

Analysing results from both *before* and *after* insecticide application, we can say the following:

• from the point of view of the ***pH***, ***the soil is neuter*** – the values in each variant both before and after insecticide application are within optimal soil pH for vegetables, i.e. 6.0-8.0 (Poşta 2008);

• ***$N_{total}$ soil supply*** for intensive vegetables crops is:

**- medium** – the values in each variant *before* insecticide application are within 0.16-0.25%;

**- normal** – the values in each variant *after* insecticide application are within 0.26-0.35% (Lixandru *et al*. 1990);

• ***phosphorus supply*** is below 36 ppm in each variant both *before* and *after* insecticide application which corresponds to a **very low supply** of this main macro-element (Borlan 1983);

• ***potassium supply*** is above 170 ppm in each variant both before and *after* insecticide application which corresponds to a **good supply** in this main macro-element (Radulov 2002).

## CONCLUSIONS

Using insecticides on a large scale resulted in numerous problems some of which have negative effects on the environment. Analyses of soil samples after insecticide application to assess their effect on some soil parameters led to the conclusion that results are within admitted limits from the point of view of environmental pollution.

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