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The Effect of Fungicides and Insecticides on the Microbiological Activity of Soil Under Sugar Beet

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Abstract: The effect of various fungicides and insecticides on the microbiological activity in the soil under sugar beet grown on carbonate chernozem, was investigated. All the fungicides and insecticides caused a decrease in the total of microorganisms, the number of fungi, ammonifiers, azotobacter, oligonitrophilic bacteria and dehydrogenasis activity, except actynomycetes which increased in number. Duet and Miral 500 GS exhibited the strongest toxic effect of all the fungicides and insecticides, respectively.

Key words: microorganisms, sugar beet, fungicides, insecticides

Introduction

A range of pesticides is, among the other chemical agents, applied to promote high yields of sugar beet. Thus, their different kinds and rates are being in use to control leaf spot of *Cercospora beticola Sacc.* (Maric and Stojsin, 1992, Ivanovic, 1998). On the other hand, in order to control beet rot weevil, *Botbynoderes punctiventris*, different rates of insecticides are used (Sekulic et al., 1998a, 1998b). Pesticides used in agricultural production may adversely

affect the environment (Dvornikova et al., 1984; Negare, 1984), although their positive effect cannot be ignored (Anderson, 1978; Eliot, 1986).

Therefore, the major objective of these studies has been to thoroughly investigate all the possible effects of the fungicides and insecticides on the microbiological activity in soil under the crops of sugar beet.

Material and Method

For these investigations, a field experiment was arranged on the carbonate chernozem type of soil with 5 replications, using the variety Dana, selected at the Institute of Field and Vegetable Crops in Novi Sad. The fungicides Alto Combi (0.5 kg/ha, Impact (0.5 kg/ha) and Duet (0.75 kg/ha) and, the insecticides Miral 500 GS (7.5 l/ha) Cimogal (1.0 l/ha) and Acetilic 50 EC (1.5 l/ha) were used for this purpose. Soil samples for microbiological analysis were taken 20 days after the treatment with fungicides and, 14 days after that with insecticides. The samples were taken in a sterile manner between the rows of sugar beet at the depth of 0-30 cm. The number of microorganisms was determined after Pochon and Tardieux (1962) and Krasiljnikov (1970), using indirect method of dilution by means of sowing of appropriate dilution on the nutritional bases. Dehydragenasis activity was determined after the method of Lenhard (1956), being modified after Thalman (1968).

Results and Discussion

It may be assumed with surety that the application of pesticides is a limiting factor of a substantial and efficient beet production. During the current studies, the use of fungicides and insecticides has thus shown a differing impact on the microbiological activity of soil under sugar beet.

All the fungicides and insecticides used, caused a great decline in the total number of microorganisms, fungi, ammonifiers, azotobacter, oligonitrophilic bacteria and a rather weakened dehydrogenasis activity, but also an increased number of actynomicetes (tab. 1, 2). Similar results were obtained by numerous authors (Kruglov et al., 1975; Hajnis et al., 1975; Negare, 1982).

In contrast to this, actynomicetes were fairly resistant to the pesticide impact so that, thanks to their substantially developed enzymatic system to highly efficiently degrade pesticides, such bacteria were able to increase in number in the soil.

A greater number of the authors (Kuduzin et al., 1973; Hajnis et al., 1979; Beck, 1970) established that fungicides had incited a higher number of actynomicetes, fungi, cellulolitic microorganisms, ammonifiers and nitrifiers.

On the basis of everything done, agricultural producers are advised to use those fungicides and insecticides, which will favour microorganisms best and their activity in soil, too. This is of great importance to both determining and increasing of bearing potential as well as to the production of the ecologically good and high quality food.

Tab.1. Effect of fungicides on the number of different microorganisms in soil under sugar beet

Microorganisms	Alto Combi		Impact C		Duet	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Total number of microorganisms (10^6/g soil)	710,4	410,8	690,9	390,3	700,7	444,8
Amonifiers (10^6/g soil)	690,9	411,1	500,5	400,0	450,3	390,9
Fungi (10^4/g soil)	25,0	20,0	26,6	13,7	28,0	19,9
Actynomicetes (10^4/g soil)	16,0	40,4	15,0	41,0	15,5	62,0
Azotobacter (10^2/g soil)	39,0	15,0	41,4	20,1	46,0	22,0
Oligonitrophilic bacteria (10^5/g soil)	350,0	210,0	300,7	201,1	410,0	220,2
Dehydrogenasis activity (μg TPF/10g soil)	840,0	520,0	800,0	490,0	860,0	340,0

Tab.2. Effect of insecticides on the microbiological activity of soil under sugar beet

Microorganisms	Miral 500 GS		Cimogal		Acetilic 50 EC	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Total number of microorganisms (10^6/g soil)	610,1	420,2	640,4	500,1	620,8	550,5
Ammonifiers (10^6/g soil)	445,2	280,9	430,3	330,3	410,1	390,2
Fungi (10^4/g soil)	24,0	20,1	26,8	24,0	25,5	20,1
Actynomicetes (10^4/g soil)	20,0	32,0	18,4	26,0	19,5	30,8
Azotobacter (10^2/g soil)	28,0	10,0	30,1	22,0	32,0	20,4
Oligonitrophilic bacteria (10^5/g soil)	350,1	180,1	330,4	240,9	310,3	270,7
Dehydrogenasis activity (μg TPF/10g soil)	800,0	320,0	840,0	540,0	800,0	620,0

Conclusion

All the fungicides and insecticides under consideration led to a lower number of the microorganisms, fungi, ammonifiers, azotobacter, oligonitrophilic bacteria and a weaker dehydrogenasis activity, except actynomicetes which increased in number.

Duet and Miral 500 GS exhibited the most toxic effect of all the fungicides and insecticides studied.

Azotobacter and oligonitrophilic bacteria appeared to be the most sensitive groups of microorganisms.

Finally, the fungicides and insecticides favouring microbiological activity in soil best are to be used in agricultural production.

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UTICAJ FUNGICIDA I INSEKTICIDA NA MIKROBIOLOŠKU AKTIVNOST U ZEMLJIŠTU POD USEVOM ŠEĆERNE REPE

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Rezime

U proizvodnji šećerne repe se koriste različite vrste fungicida i insekticida. Cilj ovih istraživanja je bio da se ispita uticaj tri fungicida i tri insekticida na mikrobiološku aktivnost u zemljištu pod usevom šećerne repe. Ogled je postavljen sa sortom Dana na zemljištu tipa karbonatni černozem u poljskim uslovima sa pet ponavljanja. Istraživanja su pokazala da su svi ispitivani fungicidi i insekticidi izazvali smanjenje ukupnog broja mikroorganizama, brojnosti gljiva, amonifikatora, azotobaktera, oligonitrofilnih bakterija i dehidrogenazne aktivnosti, a povećanje brojnosti aktinomiceta. Najosetljivija grupa mikroorganizama su azotobakter i oligonitrofilne bakterije. Od ispitivanih fungicida najtoksičnije dejstvo je ispoljio Duet, a od insekticida Miral 500 GS. U proizvodnji šećerne repe treba koristiti one fungicide i insekticide koji imaju najpovoljniji uticaj na mikroorganizme i njihovu aktivnost u zemljištu.