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EFFECT OF CERTAIN HERBICIDES ON MICROORGANISMS

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The field application of herbicides in tobacco culture allows to carry out successfull control of annual weeds with reduced number of cultivations [4, 5]. Good results can be achieved with proper herbicide combinations without desturbing the soil fertility [3]. Investigations have been carried out with Dymid and Patoran [2].

The present study shows to what extent the different herbicide combinations can influence the microorganisms and microbiological processes in soil, as well as, their effect on biological equilibrium in tobacco rizosphere.

METHODS

Field and laboratory tests with Balan (benfluralin), Patoran (metabromuron) and Dymid (diphenamid) separately and combined respectively, have been conducted. The field experiments have been carried out with *Virginia tobacco* variety $LHSE_{68} \times 1349$ on alluvial-deluvial soil type during 1970-1972. The following groups of microorganisms were studied: ammonifying bacteria (on meat-peptone agar) nitrogen fixing bacteria (on Ashby agar), actinomycetes (on starch-ammonial agar) and soil microfungi (on Čapek media). The nitrifying ability of soil, cellulose-decomposing and activity of invertase have been tested by the methods of Waksman, Pokorna and Shorl (modified) respectively [1]. All samples were taken from tobacco rizosphere.

RESULTS AND DISCUSSION

The results showed that the reduced cultivations achieved from right herbicide combination can result in temporary changes in the number of microorganisms in tobacco rizosphere (Table 1). Some depression was

observed soon after treatment, which is more remarkable when higher doses of chemicals are applied. Combined application of Balan and Patoran in doses at 0,8 kg/dkg and 0,2 kg, respectively, slightly reduces the number of both ammonifying bacteria and actinomycetes. At blooming and later growth, the number of microorganisms considerably increases due to better development of tobacco plants in this variant. The number of ammonifying bacteria and actinomycetes also increases and even exceed it, compared with the control variant (which includes 1 cultivation only). An increase of their number has also been observed in the standard variant (with 3 cultivations), which allows better development of microorganisms (water and air supply of soil is improved).

High percentage of over-grown clods with *Azotobacter* on Ashby

Table 1

Number of microorganisms under herbicide application and reduced number of cultivations /1 cultivation at the 20th day after transplanting 1972/

Variants of herbicicide application kg/dkg	Thousends per 1 g of soil				
	Total number of microorganisms	Ammonifying bacteria	Sporulating bacteria	Actinomycetes	Soil fungi
Early growth					
Balan 0.8	15.380	9.600	620	5.700	80
Balan 0.4 + Patoran 0.1	11.140	6.200	220	4.800	140
Balan 0.8 + Patoran 0.2	7.320	4.000	720	3.200	120
Dymid 0.8 + Patoran 0.2	14.170	9.500	560	4.500	170
Untreated /control -1 cultivation/	14.890	7.400	360	7.400	90
Standard /3 cultivations/	14.420	8.600	660	5.700	120
Blooming					
Balan 0.8	9.720	5.900	960	3.700	120
Balan 0.4 + Patoran 0.1	11.060	7.000	1.230	4.000	60
Balan 0.8 + Patoran 0.2	20.000	13.000	490	6.900	100
Dymid 0.8 + Patoran 0.2	16.390	12.800	830	3.500	90
Untreated -1 cultivation	15.930	10.200	1.300	5.600	130
Standard -3 cultivations	13.830	8.000	-	5.700	130
Late growth					
Balan 0.8	14.250	7.600	1.670	6.600	50
Balan 0.4 + Patoran 0.1	15.350	10.400	1.620	4.900	50
Balan 0.8 + Patoran 0.2	22.140	11.000	1.460	11.100	40
Dymid 0.8 + Patoran 0.2	7.520	5.300	1.450	2.200	20
Untreated -1 cultivation	18.150	9.600	1.740	8.500	50
Standard -3 cultivations	17.360	10.300	2.040	7.000	60

Table 2

Azotobacter /% of overgrown clods, 1971/

Herbicydes, kg/dkg	Early growth	Blooming	Later growth
Balan - 0.8	100	93	66
Balan - 0.4 + Patoran 0.1	62	80	81
Balan - 0.8 + Patoran 0.2	49	87	95
Dymid - 0.8	99	96	99
Dymid - 0.4 + Patoran 0.1	70	-	54
Dymid - 0.8 + Patoran 0.2	84	70	96
Untreated - 1 cultivation at the 7th day	65	40	51
Standard - 3 cultivations	95	100	99

media have been observed (Table 2). Balan application maintains high number of these bacteria, but at early treatment some un typically colored and depressed colonies were observed. Typical *Azotobacter chroococcum* with dark colored and well developed colonies, and with dense, characteristic consistence, has been isolated from variants using Dymid separately, or in combination. The quality of *Azotobacter* is also very high (more than 90%) in the standard variant, while in the control variant it shows a descending line. The percentage of *Azotobacter* is high during early growth and blooming, but considerably decreased at the end of the vegetative period, when characteristic changes in color and consistence of the colonies have been observed. It is very likely that the weeds which appeared in this variant, contribute to accumulation of microorganisms which exhibit antagonistic effect on *Azotobacter*.

The relatively slight changes in the number of microorganisms are related also with slighter changes in soil biological processes caused by the microorganisms. The nitrifying activity of soil shows high level almost in all variants (Table 3). More considerable decrease in the potential nitrification in the variant without treatment and cultivations has been noticed.

Considerable decrease in cellulose-decomposing ability of soil under reduced number of cultivations combined with herbicide application, have not been found, but in the most cases it was highest for the standard variant (Table 4).

Table 3

Nitrifying activity of soil under herbicide applications and reduced number of cultivations, 1970

Herbicides kg/dkg	Nitrates in mg per 1 kilo dry soil		
	At sampling	Basic nitrification	Potential nitrification
Balan - 0.8	0	27.0	179.0
Balan 0.4 + Patoran 0.1	4.3	14.1	184.6
Balan 0.8 + Patoran 0.2	3.3	34.9	167.8
Dymid 0.8 + Patoran 0.2	5.7	10.1	224.2
Untreated - without cultivation	2.3	26.3	124.4
Standard - 3 cultivations	7.7	34.2	167.1

Table 4

Cellulose-decomposing activity of soil /% of lossed cellulose/ under herbicide application and reduced number of cultivations, 1971

Herbicides kg/dkg	1 cultivation at the 7th day after transplanting			1 cultivation at the 20th day after transplanting		
	Early growth	Blooming	Later growth	Early growth	Blooming	Later growth
Balan 0.8	36.4	21.0	21.6	31.8	16.1	15.2
Balan 0.4 + Patoran 0.1	27.7	13.7	17.3	29.9	12.4	12.1
Balan 0.8 + Patoran 0.2	31.9	9.1	12.9	23.4	12.8	17.8
Dymid 0.8 + Patoran 0.2	28.4	13.8	16.3	23.5	8.8	10.7
Untreated - 1 cultivation	26.6	15.4	13.3	30.4	16.9	13.3
Standard - 3 cultivations	43.3	25.3	20.4	43.4	25.3	20.4

The invertase activity of soil shows an opposite tendency, as in fact, the lowest values were found in the standard variant (Table 5).

The final conclusion is that the herbicide application (Balan, Patoran, Dymid) combined with reduced number of cultivations does not impair the microbiological activity of soil. The temporary modifications occuring in the correlation between the different groups of microorganisms do not disturb the biological equilibrium in tobacco rhizosphere.

Table 5

Invertase activity /glucose /mg/ per soil /g/ for 24 hours/ under herbicide application and reduced number of cultivations, 1971

Herbicides kg/dkg	1 cultivation at the 7th day after transplanting		1 cultivation at the 20th day after transplanting	
	Early growth	Late growth	Early growth	Late growth
Balan 0.8	5.68	5.37	4.13	4.13
Balan 0.4 + Patoran 0.1	4.13	4.13	3.20	3.51
Balan 0.8 + Patoran 0.2	3.82	4.13	2.86	3.82
Dymid 0.8 + Patoran 0.2	4.13	5.99	3.20	3.51
Untreated - 1 cultivation	-	-	4.75	4.75
Standard - 3 cultivations	2.86	3.82	2.86	3.82

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MIKROORGANIZMY W RIZOSFERZE TYTONIU *VIRGINIA* PRZY ZASTOSOWANIU HERBICYDÓW

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Streszczenie

Przedstawiono wyniki badań dotyczące możliwości zmniejszenia ilości zabiegów agrotechnicznych przy uprawie tytoniu Virginia przez zastosowanie herbicydów: balanu, dymidu, patoranu, jak również ich wpływ na mikrobiologiczne właściwości gleby.

Przeprowadzono doświadczenia polowe i laboratoryjne z zastosowaniem herbicydów pojedynczych i w kombinacjach. Doświadczenie polowe założono na glebie aluwialno-deluwialnej w okresie od 1970 do 1972 r.

Stwierdzono, że zmniejszenie ilości zabiegów mechanicznych przy równoczesnym prawidłowym stosowaniu herbicydów z wykorzystaniem zjawisk synergizmu powoduje tylko okresowe zmiany w składzie zespołów mikroorganizmów i nie narusza równowagi w rizoferze tytoniu.

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МИКРООРГАНИЗМЫ В РИЗОСФЕРЕ ТАБАКА ВИРЖИНИЯ ПРИ ПРИМЕНЕНИИ ГЕРБИЦИДОВ

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Резюме

В работе даны результаты исследований возможностей уменьшения количества обработок табака Виржиния с применением препаратов балан, димид и паторан, а также изменения, наступающие в микробиологическом режиме почвы.

Проведены полевые и лабораторные опыты с применением гербицидов в отдельности и в комбинациях. Полевые опыты были проведены на аллювиально-деллювиальной почве, за период времени от 1970 до 1972 года.

Результаты показывают, что уменьшенное количество обработок при правильном сочетании гербицидов и использовании их синергизма приводят к временным изменениям в соотношении отдельных групп микроорганизмов и не нарушают продолжительно биологическое равновесие в ризосфере табака.