

STUDIES ON PYRETHROID RESIDUES IN WINTER RAPE

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I. Introduction

The Institute of Plant Protection has been conducted studies on the effectiveness of pyrethroids against winter rape pests since 1976. In all the experiments the results obtained after the application of pyrethroids were better than or at least equal to those obtained after the application of organophosphorus chemicals or carbamates /Witkowski et al. 1981; Mrówczyński et al. 1984; Pieczonka, Mrówczyński, 1985; Witkowski et al. 1986/. Table 1 summarizes rates of active ingredients and pre-harvest intervals of pyrethroids registered in Poland for winter rape protection.

In Canada, FRG and Great Britain studies were conducted on cypermethrin residues in rapeseed after the application of the chemical Ripcord. Most of the samples showed no cypermethrin residues above the limit of determination, i.e. 0.01 mg/kg. Only seed samples from Canada 6 weeks after the treatment were found to have cypermethrin residues from 0.01 to 0.12 mg/kg /Anonim 1, 1980/.

In Switzerland, Finland, FRG and France it was found that rape seed during 51-87 days after the application of Decis had deltamethrin residues below 0.05 mg/kg /Anonim 2, 1981/.

Rape seed from Canada after the application of Sumicidiaz were found to have 0.11 mg/kg fenvalerate residues in two samples 42 days after the treatment, whereas the remaining samples showed no fenvalerate residues above 0.01 mg/kg /Anonim 3, 1982/.

In view of the lack of data concerning degradation of pyrethroids in green rape, very long pre-harvest intervals have been established for the actually registered chemicals for winter rape protection, namely: for cypermethrin - 49

days, for fenvalerate - 56 days and deltamethrin - 35 days.

The purpose of this paper was to determine the level of pyrethroid residues in seeds, pods and straw, as well as to determine the dynamics of these residues degradation in green matter.

II. Methods

Field trials in 1982-1985 were carried out on plots covering 100 m² at the Experimental Department - Przybroda belonging to The University of Agriculture in Poznań and at the Experimental Station of the Plant Protection Institute in Winnogóra. In these trials different rates of chemicals were applied. Rape was sprayed once at full flowering against *Ceutorhynchus assymilis* Payk. and *Dasyneura brassicae* Winn. or twice - before plant flowering against *Meligethes assimilis* F. and at full flowering of plants against *C. assymilis* Payk. and *D. brassicae* Winn.

For the analysis samples of green rape /20 plants/ from 0 to 26 days after the treatment and samples of seeds, pods and straw were randomly collected during harvest.

The determination method of alphamethrin, biphenethrin, cypermethrin, deltamethrin and fenvalerate residues in the discussed material was worked out at the Institute of Plant Protection in Poznań. It consists of extraction of samples by organic solvents. Extracts are cleaned-up by solvent partition and on a Florisil column. The final determination is carried out on a gas chromatograph with an electron capture detector. The limit of determination for all the mentioned pyrethroids is 0.01 mg/kg.

III. Discussion of the Results and Conclusions

In 1982 the dynamics of cypermethrin degradation in green matter /Fig. 1/ as well as cypermethrin residues in straw, pods and seed after the application of Ripcord 10 EC and Ripcord 40 EC for winter rape protection were studied /Table 2/. Cypermethrin residues in rape immediately after the second treatment are from 0.81 to 2.15 mg/kg. These quantities are half-reduced already after 3-4 days, and 12 days

after the second treatment they attain the level below 0.20 mg/kg.

Cypermethrin residues in straw from 0.03 to 0.17 mg/kg are on a similar level as in green matter already 12 days after the second treatment. Seed and pod samples were not found to have cypermethrin residues above the limit of determination of the method /0.01 mg/kg/.

According to the data of FAO/WHO Reports, maximum permissible cypermethrin residues in the seed of oil-plants - 0.2 mg/kg are proposed /Anonim 1, 1980/.

Cypermethrin is a mixture of 8 stereoisomers, of which two the most active ones were isolated as alphamethrin. Alphamethrin is an active ingredient of the preparation Fastac 10 EC /Harris, 1985; Fisher et al. 1983/. In 1984 the dynamics of alphamethrin degradation in green matter and its residues in straw, pods and seeds after the application of Fastac 10 EC were studied /Fig. 2/.

Alphamethrin residues in green matter after treatment are from 0.18 to 0.43 mg/kg depending on the applied dose of the chemical and on the number of treatments. These residues are half-reduced already 3 days after the treatment, but after 12 days they are below 0.1 mg/kg in all the samples. Alphamethrin residues in the green rape samples 25 days the treatment and in straw samples collected during harvest - 68 days after the application of this chemical are the same amounting to 0.02 mg/kg. No alphamethrin residues above the limit of determination of the method were found in seed samples.

In 1983 deltamethrin residues were studied after the application of the insecticides Decis 2.5 EC and Decis 2.5 flow /Table 4/, as well as fenvalerate residues after the application of Sumioidin 20 EC /Table 5/ in green rape, straw, pods and seeds.

The studied seed samples were not found to have deltamethrin and fenvalerate residues above the limit of determination of the method /0.01 mg/kg/.

According to the data of FAO/WHO Reports, 0.1 mg/kg maximum permissible deltamethrin and fenvalerate residues in

the seeds of oil-plants are proposed /Anonim 2, 1981; Anonim 3, 1982/.

In 1985 bifenthrin residues in seeds, straw and pods after the application of Talstar 10 EC were studied /Table 6/. The seeds were not found to have bifenthrin residues above the limits determination of the method /0.01 mg/kg/.

All the discussed studies were carried out on the winter rape cultivar Jet Neuf.

In 1984 chemical treatments with Decis 2.5 EC at the rate of 7.5 g deltamethrin per 1 ha /0.3 l per 1 ha/ and with Fastac 10 EC at the rate of 12 g alphamethrin per 1 ha /0.12 l per 1 ha/ were performed on different winter rape varieties:

- with a high erucic acid content - Górczański and Skrzyszowicki;
- with a low erucic acid content - Beryl, Jupiter and Jet Neuf;
- and erucic acid-free with a low content of thioglikosides - Jantar, Start and the strain BKH-180.

In the studied rapeseed samples no alphamethrin and deltamethrin residues above the limit of determination of the method were found.

Summing that up, it should be inferred that in the studied seed samples of winter rape no pyrethroid residues were found irrespective of the kind of applied chemical, number of treatments and variety of a cultivated plant.

On the basis of the results of the studies concerning the dynamics of degradation of cypermethrin and alphamethrin residues and the residues of bifenthrin and fenvalerate in green matter it may be proposed to reduce the obligatory so far pre-harvest interval for the discussed chemicals to 10-14 days.

References

1. Anonim 1, 1980. Pesticide residues in food: 1979 evaluations, FAO, Roma: 159-214.
2. Anonim 2, 1981. Pesticide residues in food: 1980 evaluations, FAO, Roma: 112-179.

3. Anonim 3, 1982. Pesticide residues in food: 1981 evaluations, FAO, Roma: 209-256.
4. Fisher J., Robinson J., Debray P., 1983. WL 85871 - a new multipurpose insecticide /Fastac/. Proceedings International Congress of Plant Protection: 453-459.
5. Harris B., 1985. The development of synthetic pyrethroids, their role in efficient crop protection and the continued improvement in this insecticide group. Proceedings XXV Scientific Session IOR, Poznań: 183-199.
6. Mrówczyński M., Witkowski W., Ciesielski F., Wachowiak M., 1984. Zastosowanie nowych insektycydów do zwalczania chowacza podobnika /Ceutorhynchus assimilis Payk./ i przyszczarka kapustnika /Dasyneura brassicae Winn./ w rzepaku ozimym. Materiały XXIV Sesji Naukowej IOR: 209-217.
7. Pieczonka G., Mrówczyński M., 1985. Badanie pozostałości pyretroidów w rzepaku ozimym. Materiały XXV Sesji Naukowej IOR: 439-449.
8. Witkowski W., Mrówczyński M., Ciesielski F., 1981. Skuteczność pyretroidów w zwalczaniu chowaczy lodygowych /Ceutorhynchus sp./ w rzepaku ozimym. Materiały XXI Sesji Naukowej IOR: 359-371.

Table 1

Active ingredient rates and pre-harvest intervals of pyrethroids registered in 1987 in Poland for protection of winter rape

Active ingredient	Preparation	Dosage /a.i.g/ha/	Pre-harvest intervals /days/
alphamethrin	Fastac 10 EC	8-12	49
cypermethrin	Cymbush 10 EC Cymbush 25 EC Cyperkil 25 EC Ripoord 10 EC Sherpa 25 EC	25-30	49
deltamethrin	Decis 2.5 EC Decis 0.5 ULV	6.25-8.75	35
fenvalerate	Sumicidin 20 EC	80-100	56

Table 2

Cypermethrin residues in winter rape during harvest in 1982

Preparations	Rate		Number of treatments	Cypermethrin residues /mg/kg/		
	preparation /l/ha/	cypermethrin /g/ha/		straw	Pods	seeds
Ripeord 10 EC	0.25	25	2	0.03	< 0.01	< 0.01
Ripeord 10 EC	0.40	40	2	0.08	< 0.01	< 0.01
Ripeord 40 EC	0.06	24	2	0.17	< 0.01	< 0.01
Ripeord 40 EC	0.10	40	2	0.10	< 0.01	< 0.01

Table 3

Cypermethrin residues in winter rape in 1983

Preparations	Rate		Number of treatments	Cypermethrin residues /mg/kg/				
	preparation /l/ha/	cypermethrin /g/ha/		green matter		straw	Pods	seeds
				I	II			
Ripeord 10 EC	0.25	25	1	0.24	0.10	0.07	0.02	< 0.01
Ripeord 10 EC	0.25	25	2	0.33	0.06	0.02	< 0.01	< 0.01
Cymbush 10 EC	0.25	25	1	0.62	0.12	< 0.01	< 0.01	< 0.01
Cymbush 25 EC	0.10	25	1	0.37	0.13	0.14	0.06	< 0.01
Cymbush 25 EC	0.10	25	2	0.38	0.07	0.01	< 0.01	< 0.01
Sherpa 25 EC	0.10	25	1	0.37	0.06	0.06	0.02	< 0.01

I - immediately after last treatment

II - 26 days after last treatment

Table 4

Deltamethrin residues in winter rape in 1983

Preparations	Rate		Number of treatments	Deltamethrin residues /mg/kg/			
	preparation /l/ha/	delthamethrin /g/ha/		green matter		straw	seeds
				I	II		
Decis 2.5 EC	0.3	7.5	1	0.11	0.03	0.02	< 0.01
Decis 2.5 EC	0.3	7.5	2	0.22	0.09	0.01	< 0.01
Decis 2.5 flow	0.3	7.5	1	0.05	0.04	< 0.01	< 0.01

I - immediately after last treatment II - 26 days after last treatment

Table 5

Fenvalerate residues in winter rape in 1983

Preparations	Rate		Number of treatments	Fenvalerate residues /mg/kg/			
	preparation /l/ha/	fenvalerate /g/ha/		green matter		straw	seed
				I	II		
Sumicidin 20 EC	0.3	60	1	0.57	0.64	< 0.01	< 0.01
Sumicidin 20 EC	0.3	60	2	2.26	0.05	0.15	< 0.01
Sumicidin 20 EC	0.5	100	1	1.78	0.13	0.05	< 0.01

I - immediately after last treatment II - 26 days after last treatment

Table 6

Biphenethrin residues in winter rape in 1985

Preparations	Rate		Number of treatments	Biphenethrin residues /mg/kg/			
	preparation /l/ha/	biphenethrin /g/ha/		straw	pods		seeds
					straw	seeds	
Talstar 10 EC	0.2	20	1	0.31	0.05	< 0.01	< 0.01
Talstar	0.25	25	1	0.88	0.69	< 0.01	< 0.01

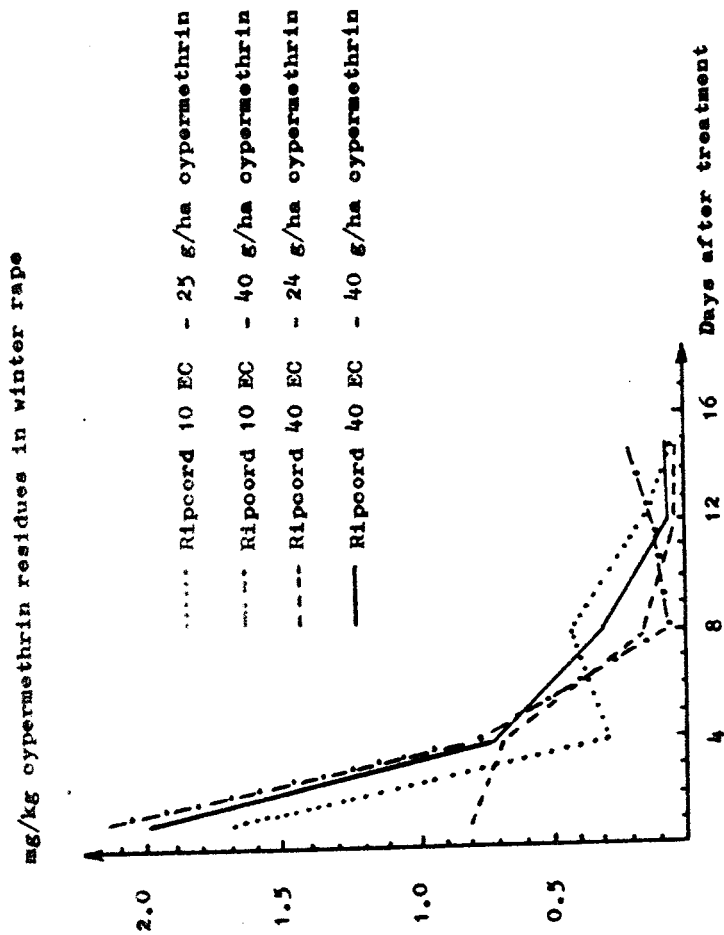


Fig. 1 - Dynamic of cypermethrin degradation in green matter in winter rape in 1982

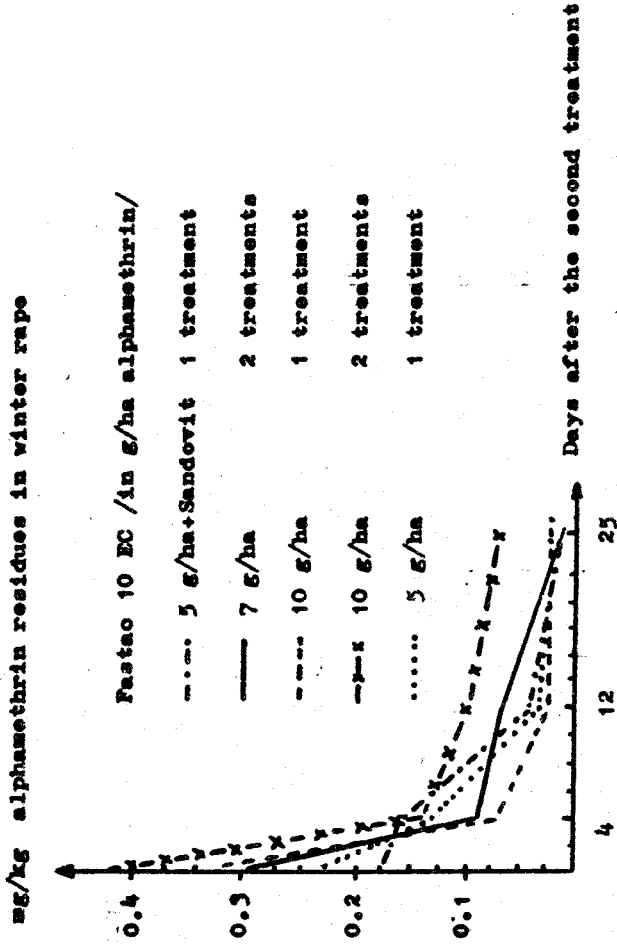


Fig. 2. Dynamic of alphamethrin degradation in green matter in 1984