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EFFECTS OF SIX YEAR HERBICIDES USE ON POPULATION DYNAMICS OF MIGRATORY PLANT PARASITIC NEMATODES IN THE FIELD

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Abstract. The 1987-1992 microplots experiment was conduced in agricultural field conditions under routine crop, and herbicide rotation. Over the experimental time only the endoparasitic species, *Pratylenchus neglectus* revealed significant changes in the population dynamics. In a sugar beet the nematode population decreasad in microplots treated with chloridazon (3.25 kg/ha) or cycloate (4.44 kg/ha) but increased in the control. In a winter rape the population of *P. neglectus* increased in microplots treated with benazolin (0.45 kg/ha) but it decreased in the control. The observed trends in the dynamics of the nematode population persisted for one year only, and they were changed with the rotation of crop and herbicides. No differences betwen herbicides treated, and control microplots were observed with linuron + bentazone (1.0 kg/ha + 1.5 kg/ha, respectively) was applied to pea culture, metabenzthiazuron (2.8 kg/ha) was applied to a winter wheat, and MCPA as sodium salt + dicamba as sodium salt (0.725 kg/ha + 0.08 kg/ha, respectively) was applied to a spring wheat. The examined crops and herbicides did not markedly affect the population dynamics of ectoparasitic *Tylenchorhynchus dubius*, *Helicotylenchus digonicus* and *Mesocriconema curvatum*.

Key words: nematodes, herbicides, population dynamics

I. INTRODUCTION

Previous observations can not answer the question about the relations between herbicides used in the field and population dynamics of nematodes. Weischer and Müller (1985) reviewed literature did not be able to generalise this phenomen, because appeared that the influences were different and depended not only on active ingredient but on species of nematode also. Later publications confirmed those observations (Hengestebeck 1988). Thus, it seems to be purposeful to continue the studies and collect additional data.

The purpose of this work was to describe changes in population dynamics of four migratory plant parasitic nematode species resulting from the use of herbicides, under conditions of commercial agriculture in the region of Poland with intensive sugar beet production.

II. MATERIAL AND METHODS

The experiment was carried out in the years 1987-1992 in the area of Toruń, on microplots (2 × 2 m, 6 replications) drowned in the field with the soil naturally infected by *Pratylenchus neglectus* (Rensch), *Tylenchorhynchus dubius* (Bütschli), *Helicotylenchus digonicus* Perry and *Mesocriconema curvatum* (Raski). Soil sampling were done immediately before sowing and 2-3 weeks after harvesting. For each sample 20 cores (∅ 2 cm, 20 cm

depth) from central part (1 × 1 m) of microplot were taken. The nematodes were extracted from 400 cm^3 volume of each soil sample by centrifugal flotation, than counted under microscope. The evaluation of obtained data was done using the graphic form of Seinhorst's (1966) model. Sequence of cultures in respectively years, applied herbicides and those doses were as follow:

1987	sugar beet	chloridazon (Pyramin 65 WP, BASF)	3.25 kg/ha
1988	pea	linuron (Afalon 50 WP, Hoechst) +bentazone (Basagran, Organika–Sarzyna)	1.0 kg/ha 1.5 kg/ha
1988-1989	winter rape	benazolin (Cresopur, Agrolinz)	0.45 kg/ha
1989-1990	winter wheat	methabenzthiazuron (Tribunil 70 WP, Bayer)	2.8 kg/ha
1991	sugar beet	cycloate (Ro-nett 6E, ICI)	4.44 kg/ha
1992	winter wheat	MCPA as sodium salt +dicamba as sodium salt (Chwastox D, Organika-Sarzyna)	0.725 kg/ha 0.08 kg/ha

At control microplots weeding was used instead of the chemicals.

III. RESULTS

Over the experimental time the endoparasitic species, *Pratylenchus neglectus* reveald significant changes in the population dynamics. In a sugar beet the nematode population decreased in microplots treated with chloridazon or cycloate but increased in the control (Figs. 1, 2). Probably cycloate and chloradizon changed the property of sugar beet plants, so these occured to be less suitable as host for *P. neglectus*. In the winter rape population of *P. neglectus* increased in microplots treated with benazolin but decreased in the control (Fig. 3). The presumption is that benazolin changed the winter rape plants property, so it occured to be more suitable as host for *P. neglectus*.

The observed trends in the *P. neglectus* population dynamics persisted for one year only, and they were changed with the rotation of crops and herbicides. No differences betwen herbicide tereated and control microplots were observed when linuron + bentazone was applied to pea culture, methabenzthiazuron was apllied to a winter wheat, and MCAP as sodium salt + dicamba was applied to a spring wheat.

The examined crops and herbicides did not markedly affect the population dynamics of ectoparasitic *Tylenchorhynchus dubius, Helicotylenchus digonicus* and *Mesocriconema curvatum*.

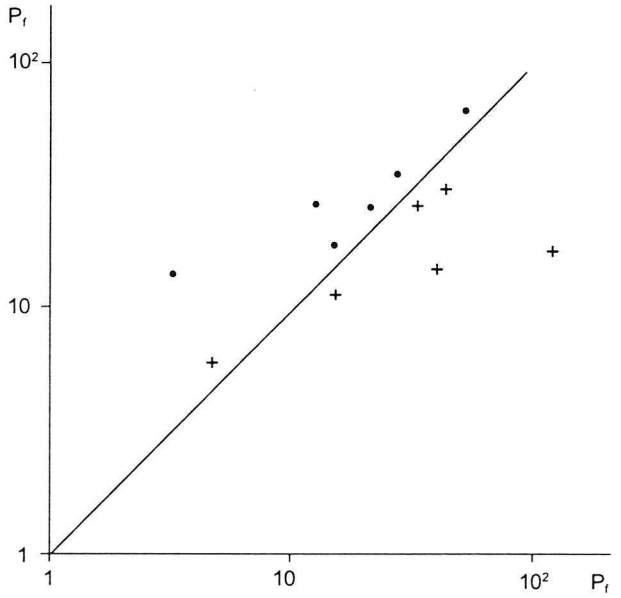

Fig. 1. Effects of chloridazon (3.25 kg/ha) (+), in compare to control (•), on population dynamics of *Pratylenchus neglectus* (ind./100 cm^3) on sugar beet

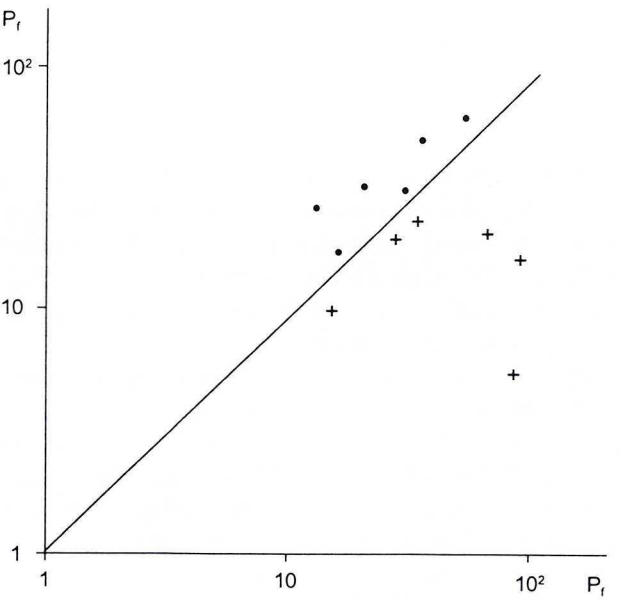

Fig. 2. Effects of cycloate (4.44 kg/ha) (+), in compare to control (•), on population dynamics of *Pratylenchus neglectus* (ind./100 cm^3) on sugar beet

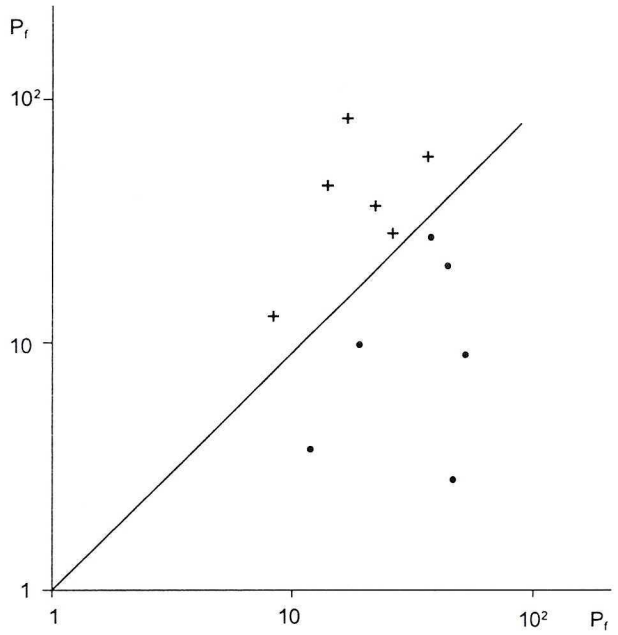

Fig. 3. Effects of benazolin (0.45 kg/ha) (+), in compare to control (•), on population dynamics of *Pratylenchus neglectus* (ind./100 cm^3) on winter rape

The results obtained in the experiment showed that commercial application of herbicides influenced upon endoparasitic species only, which lay eggs into plants roots. The ectoparasitic species laying eggs ouside the plant did not show any response to applied herbicides.

IV. DISCUSSION

Therefore, it seems to be the most probably that herbicide influence appears in relation to earlier stages of nematode development. It acts throug the plant as a medium. Such thesis is indirectly confirmed by numerous observations of strong effects of some herbicides on nematode hatch (Banaszak 1997; Beane and Perry 1990; Hengstebeck 1988; Kraus 1981, Wong et al. 1994). The literature overview (Weischer and Müller 1985) also suggests that visible effects of herbicide action on nematode populations occur mainly in respect to species, which lay eggs into plant tissues. But the same overview make impossible to draw clear-cut conclusion, becouse various methods were used by researchers. That is why more precise experiments are need.

Irrespective to observed impact of some herbicides on some nematode species, reasonable seems to be conclusion of Weisskopf et al. (1988). According to them the herbicides used at commercial doses are able to make one year effects on the population dynamics, which than come back (equalises) to natural level during next years.

V. LITERATURE

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WPŁYW SZEŚCIOLETNIEGO STOSOWANIA HERBICYDÓW NA DYNAMIKĘ POPULACJI CZTERECH GATUNKÓW MIGRUJĄCYCH NICIENI-PASOŻYTÓW ROŚLIN W WARUNKACH POLOWYCH

STRESZCZENIE

W latach 1987-1992 przeprowadzono doświadczenie w warunkach polowych, przy zastosowaniu komercyjnego płodozmianu i herbicydów. W czasie doświadczenia tylko endopasożytniczy gatunek *Pratylenchus neglectus* wykazał zauważalne różnice w dynamice populacji pod wpływem stosowania herbicydów. Na buraku cukrowym populacja nicieni spadła pod wpływem stosowania chloridazon (3,25 kg/ha) lub cycloate (4,44 kg/ha), podczas gdy na kontroli bez herbicydów – wzrosła. Na rzepaku ozimym populacja *P. neglectus* zwiększyła się pod wpływem stosowania benazolin (0,45 kg/ha), a na kontrolowanych bez herbicydów spadła. Te trendy w dynamice populacji utrzymały się tylko w jednym roku i uległy zmianie po zmianie uprawy i herbicydów. Nie zaobserwowano różnic w dynamice populacji *P. neglectus* pod wpływem zastosowania linuron + bentazone (1,0 kg/ha + 1,5 kg/ha, odpowiednio) w uprawie grochu, methabenzthiazuron (2,8 kg/ha) w pszenicy ozimej oraz MCPA w postaci soli sodowej + dicamba w postaci soli sodowej (0,725 kg/ha + 0,08 kg/ha) w pszenicy jarej. Żaden z herbicydów nie spowodował zauważalnych zmian w dynamice populacji nicieni ektopasożytniczych: *Tylenchorhynchus dubius, Helicotylenchus digonicus* i *Mesocriconema curvatum*.