

INFLUENCE OF ARABLE FARMING SYSTEMS ON WEED INFESTATION

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Summary

The objectives of this study was to investigate the influence of an ecological and integrated farming system on development of weed seedbank in soil and actual weed infestation. According to the achieved results it is evident, that the farming system showed higher influence on development of weed infestation than the system of soil cultivation. The minimum soil cultivation in ecological system significantly enhanced the weed seedbank. Under conventional soil cultivation the differences in viable weed seeds between the systems were not significant. The highest weedstock in all years had *Amaranthus retroflexus* L., which dominance was supported by ecological system and minimum soil cultivation. Significant differences in actual weed infestation were observed between the soil cultivation systems and farming systems. The farming system did not influence the total number of detected weed species, but changes in weed species composition were detected.

Key words: ecological farming system, integrated farming system, weed seedbank, actual weed infestation, conventional soil cultivation, minimal soil cultivation

Introduction

The crop-weed system is dynamic and its behaviour may change with environmental and cropping conditions. Interactions between crop and weed flora are influenced by such factors as crop species, crop rotation, crop-weed competition, cultivation methods, water conditions, fertilisation, weed control methods and composition of the weed seedbank. From a practical viewpoint, weed seedbank studies aim to acquire information on the actual weed infestation which would possibly develop in the subsequent crops.

Material and methods

The aim of this study was to determine the influence of an ecological and integrated farming system on development of weed seedbank in soil and their relation with the weed infestation. Field experiment were established at the Slovak Agricultural University Research Station Dolná Malanta on brown clay-loamy soil in 1990. In ecological farming system the following crop rotation has been used: bean with alfalfa undersowing – alfalfa – winter wheat (intercrop) – silage maize – winter rape (intercrop) – common pea (intercrop) – grain maize – winter wheat. In integrated system the following crop rotation has been used: alfalfa (extrarotation plot) - grain maize – silage maize – winter wheat (intercrop) – sugar beet – spring barley (intercrop) – common pea – winter wheat. In both systems were examined two variants of soil cultivation: 1. conventional with ploughing to the depth of 0,24 m; 2. minimal with shallow cultivation to the depth of 0,12 – 0,15 m. Weed seedbank was determined in the years 1990, 1996, 1998 on two plots of each system, in the depths of 0,0 – 0,05 m; 0,2 – 0,25 m in seven replications. The actual weed infestation was evaluated two times in 1998 during vegetative period (spring and summer aspect) according to the EWRS method (species composition and number of weeds per m² was determined by counting).

Results and discussion

Weed seedbank in 1996 (tab. 2) in ecological system was significantly higher 7,5 times in the average per m² in comparison with the year 1990 (tab. 1). Soil cultivation had a significant influence on a weedstock and was expressed by higher number of weed seeds under minimum cultivation. In this case during the last two years, total number of viable weed seeds was 8,4 times higher as compared with the year 1990 (41 014 weed seeds per m²).

There were no significant differences between the systems when using conventional cultivation. During evaluated years, 21 weed species were detected in the ecological system. Dominant weed species was *Amaranthus retroflexus* L. with the share of 67,4 % in 1990. After six and eight year period its share was 96,4 % and 95,1. The most frequent species were beside the above-mentioned *Chenopodium album* L., *Chenopodium polyspermum*. Weed species *Persicaria lapathifolia*, *Polygonum aviculare* L., *Atriplex patula* L., *Capsella bursa-pastoris*, *Papaver rhoas* L., *Stellaria media*, *Veronica hederifolia* L., *Sinapis arvensis* L. did not occur any more, the other new species *Galium aparine* L., *Thlaspi arvense* L., *Fallopia convulvulus*, *Pesicaria maculata* were imported. Weed seedbank in integrated system significantly rose up in 1996. In comparison with year 1990 it was 2,5 times. The whole seedstock in both depths of soil reached the highest rate, 24 356 seeds per m² in 1996. The soil cultivation did not have a significant influence on changes of weed seedbank. *Amaranthus retroflexus* L.

dominantly represented all 22 of the determined weed species. Its ratio from the whole weed seedstock was 80,6 % in 1990. In 1996 its ratio rose to 87,7 % and in 1998 (tab. 3) *Amaranth* reached 94,7 %. There was no significant influence of integrated system on changes of the number of weed species.

Table 1

Number of weed seeds in soil per m² in 1990

Weed species	Ecological farming system				Integrated farming system			
	0,0-0,05 m		0,2-0,25 m		0,0-0,05 m		0,2-0,25 m	
	Con. ⁽¹⁾	Min. ⁽²⁾	Con.	Min.	Con.	Min.	Con.	Min.
AMARE	1 250	1 969	1 438	1 250	2 969	4 625	4 313	2 938
ATRPA	125	188	-	188	63	156	-	-
CAPBP	-	31	125	-	31	-	-	-
CHEAL	219	188	63	63	344	344	125	63
CHEPO	-	31	-	-	-	-	-	-
CUSTR	-	-	188	-	-	-	-	-
ECHCG	31	94	188	313	376	375	313	63
PAPRH	-	94	-	-	-	-	-	63
PERLA	63	94	125	63	157	188	63	63
POLAV	32	32	-	-	31	63	-	125
SINAR	31	32	-	-	-	63	-	-
STEME	-	-	-	125	-	63	63	-
THLAR	-	-	-	63	125	-	-	-
VERHE	-	-	-	63	31	125	63	-
Total	1 751	2 753	2 127	2 128	4 127	6 002	4 940	3 315

(1) conventional soil cultivation, (2) minimal soil cultivation

Table 2

Number of weed seeds in soil per m² in 1996

Weed species	Ecological farming system				Integrated farming system			
	0,0-0,05 m		0,2-0,25 m		0,0-0,05 m		0,2-0,25 m	
	Con. ⁽¹⁾	Min. ⁽²⁾	Con.	Min.	Con.	Min.	Con.	Min.
AMARE	11 125	21 917	8 667	21 933	11 042	13 250	5 389	13 056
ATRPA	-	-	-	-	-	-	-	-
CHEAL	750	375	-	-	667	417	-	83
CHEPO	-	-	458	84	-	-	320	764
CONAR	-	-	-	-	125	-	500	-
ECHCG	42	42	-	-	125	-	-	-
FALCO	-	-	42	-	250	-	-	-
GALAP	-	42	-	-	-	-	-	-
PERMA	125	42	42	292	583	292	167	250
RUMCR	-	-	-	-	125	-	167	222
THLAR	42	-	-	-	42	167	42	167
TRIIN	-	-	-	-	84	-	417	-
Total	12 084	22 418	9 209	22 309	13 043	14 126	7 002	14 542

In both farming systems variant with minimal cultivation had higher actual weed infestation than conventional one (tab. 4). This could be explained by the higher weed seedstock in the soil. Significant differences were observed between different soil cultivation and between farming systems. In ecological system was higher weed species competition than in integrated. Differences were also found in number of weeds per m², where in ecological system were determined about 26 % higher weed infestation than in integrated one. Dominant weeds species in the spring aspect were *Cirsium arvense*, *Capsella bursa pastoris*, *Tripleurospermum inodorum*. In summer aspect the most dangerous weed species was *Cirsium arvense*.

Table 3

Number of weed seeds in soil per m² in 1998

Weed species	Ecological farming system				Integrated farming system			
	0,0-0,05 m		0,2-0,25 m		0,0-0,05 m		0,2-0,25 m	
	Con. ⁽¹⁾	Min. ⁽²⁾	Con.	Min.	Con.	Min.	Con.	Min.
AMARE	15 250	16 600	11 850	18 650	9 600	10 800	10 350	5 000
ATRPA	50	150	-	-	-	-	-	-
CAPBP	-	-	100	50	-	-	-	-
CHEAL	-	-	100	50	150	-	-	-
HELAN	-	-	-	-	-	100	-	-
MELAL	-	-	-	50	-	-	-	50
PERMA	50	300	250	400	50	400	50	-
POLAV	-	-	250	-	-	-	-	-
RUMCR	-	100	-	100	-	50	-	250
SCLAN	-	50	-	-	-	-	-	-
SINAR	-	-	-	100	125	-	150	50
THLAR	42	-	-	-	-	-	-	-
TRIAE	250	700	50	-	200	250	-	-
VERHE	-	-	-	-	-	-	-	100
Total	15 642	17 900	12 600	19 400	10 125	11 600	10 550	5 450

Table 4

Actual weed infestation in 1998

Weed species	Ecological farming system				Integrated farming system			
	Spring aspect		Summer aspect		Spring aspect		Summer aspect	
	Con. ⁽¹⁾	Min. ⁽²⁾	Con.	Min.	Con.	Min.	Con.	Min.
CAPBP	6	8	-	-	6	8	-	-
CARDR	3	6	3	4	3	5	-	-
CIRAR	4	10	4	6	4	6	4	6
CONAR	3	2	-	-	-	-	-	-
FALCO	-	-	-	1	-	-	2	4
LAMAM	3	2	-	-	2	6	1	2
MEDSA	-	-	1	3	-	-	-	-
PAPRH	2	5	1	2	-	3	-	1
STEME	4	2	-	-	2	4	-	-
THLAR	2	4	-	-	4	6	1	2
TRIBE	6	8	4	8	4	6	-	-
VIOAR	2	2	-	-	2	3	-	-
Total	25	59	13	24	27	47	8	15

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