EXAMINATIONS OF WEED COVER IN THE NYÍRLUGOS LONG-TERM FIELD EXPERIMENT

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Abstract: The experiment was conducted on the Nyírlugos experimental field of Institute for Soil Science and Agricultural Chemistry. The long-term experiment was set up in 1962 to study the effect of variorus agronomic interventions on acid sandy brown forest soil typical of the region. In this area the effects of different levels of nutrient supply have been examined in triticale monoculture since 1991. The upper layer of sandy soil quickly loses its water content due to its physical properties, and this may possibly result in special weed composition. We studied the effect of different fertilizer treatments on the weed flora composition, and density of each species. Examination of the weed cover was performed in four treatments (N:P:K: 0:0:0, 50:0:0, 150:0:0, 100:120:120 kg ha^{-1} $year^{-1}$) with 3 replications taken before harvesting of triticale. In the experiment there was no weed control prior to the survey. On the examined plots 14 weed species were found. The annual species were present in more than 95 % of the weed cover. *Apera spica-venti* (L.) P.B. dominated in the control and in the N treatments competing with the cultivated plant. The cover of *Ambrosia artemisiifolia* L. decreased with increasing N dose, but its cover enlarged several fold in the NPK treatments. With increasing N doses, the cover of *Spergula arvensis* L. increased, but in the combined treatments it was barely present.

Keywords: triticale, weed diversity, cover, density, different levels of nutrient supply

Introduction

Weeds mean a major problem in crop production (Tuesca et al., 2004; Lehoczky and Kismányoky, 2010), but they can thrive especially in monoculture conditions (Kismányoky and Lehoczky, 2007). Weeds can compete with cultivated plants not only for niche reservation and sunlight, but also for water and nutrients. On weedy areas the risk of crop infection may be higher, therefore the damages of weeds can manifest directly or indirectly in yield loss and deterioration (Csathó et al., 2014; Lehoczky et al., 2012, 2014a, 2014b). In the Nyírség area the rainfall of around 200 mm during the growing season in drought years is not enough for safe crop growing. The upper layer of sandy soil loses its water content quickly and the young plants are not able to reach and utilize the water in the deeper soil layers (Kádár et al., 2011) so the development of the vegetation and the efficiency of fertilizers are greatly influenced by the rainfall and temperature conditions. The experiment set up 53 years ago gives a good opportunity to examine the effect of fertilization on weed vegetation in this Nyírség area or other grain production areas with similar characteristics.

Materials and methods

The experiment was set up in the autumn of 1962 in order to study the effect of different agronomic interventions on the fertility of a brown forest sandy soil in Nyírség. Since 1991, nearly a quarter of a century, triticale monoculture has been grown on the experimental field (Kádár et al., 2011). The amount of seed used for sowing of the winter *triticale (variety Disco)* was 300 kg ha^{-1}. In the experiment, there are 32

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treatments in four replications arranged in randomized factorial block, from which control plots and three treatments were examined in terms of weed flora composition. The size of the plots were 10 x 5 m. Half of the nitrogen supply was applied before sowing in autumn, the other half in spring. The potassium and phosphorus are applied in every five years. The control plots are without any fertilization. The coverage percent of the total weed flora as well as each weed species was estimated on one square meter per plot before the harvesting of triticale on 3rd July 2013. The counting of plant individuals was made in the control, the N_{50} and the N_{150} treatments. Weed control and other plant protection treatments were not done in the experiment except for the common agronomical *(mechanical)* procedures like stubble cultivation, ploughing and the sowing preparation. The statistical processing of experimental data was made with MStat software at 95% confidence level.

Results and discussion

In the test plots 13 weed species occurred, six monocotyledonous, 5 dicotyledonous and 2 species from horsetail class. More than 95 % of the weed cover was consisted by annual species. Eight weed species were found in the control treatment, there were less species on plots treated only with nitrogen *(N_{50} 6 species, N_{150} 4 species)*, while NPK treatment had the greatest number of species *(9 species) (Table 1)*.

Table 1. Frequency and cover of weed species on the experimental plots in 2013

No	Weed species	Bayer code	Freq.	Cover (%) Ø	N_{50}	N_{150}	NPK	Average
1.	*Apera spica-venti* (L.) P. B.	APESV	12	14.7	24.0	20.3	31.3	22.58
2.	*Ambrosia artemisiifolia* L. *	AMBEL	11	3.0	2.5	1.2	30.0	9.17
3.	*Spergula arvensis* L.	SPEAR	8	0.2	8.3	11.7	0.9	5.27
4.	*Anthemis arvensis* L. *	ANTAR	8	1.8	1.5	0.0	11.0	3.58
5.	*Digitaria sanguinalis* (L.) Scop. *	DIGSA	8	0.4	0.2	4.7	0.2	1.36
6.	*Equisetum ramosissimum* L.	EQURA	2	7.3	0.0	0.0	0.0	1.83
7.	*Persicaria lapathifolia* (L.) S.F.Grey.	POLLA	2	0.0	0.0	0.0	0.2	0.05
8.	*Viola arvensis* Murr.	VIOAR	2	0.0	0.07	0.0	0.0	0.02
9.	*Poa pratensis* L.	POAPR	1	0.0	0.0	0.0	0.3	0.08
10.	*Equisetum arvense* L.	EQUAR	1	0.2	0.0	0.0	0.0	0.04
11.	*Elymus repens* (L.) Gould.	AGRRE	1	0.0	0.0	0.0	0.2	0.04
12.	*Setaria pumila* (L.) P. B.	SETPU	1	0.03	0.0	0.0	0.0	0.01
13.	*Rumex acetosella* L.	RUMAC	1	0.0	0.0	0.0	0.03	0.01
	Total ($LSD_{5\%}$: 29.14)			27.6	36.6	37.9	74.1	44.4

*Significant differences in weed cover among the treatments (AMBEL $LSD_{5\%}$:5.5, ANTAR $LSD_{5\%}$:7.17, DIGSA $LSD_{5\%}$:3.17)

The total weed coverage increased due to fertilization. The cover was significantly higher in the NPK treatment than in the other examined treatments. *Apera spica-venti* (L.) P.B. dominated in all the treatments, actively competing with the crop. *Ambrosia artemisiifolia* L., *Spergula arvensis* L. and *Digitaria sanguinalis* (L.) Scop. were present in all the observed treatments (*Figure 1*).

Abundance and coverage of *D. sanguinalis* increased significantly in the treatment with extreme N-supply compared to control plots.

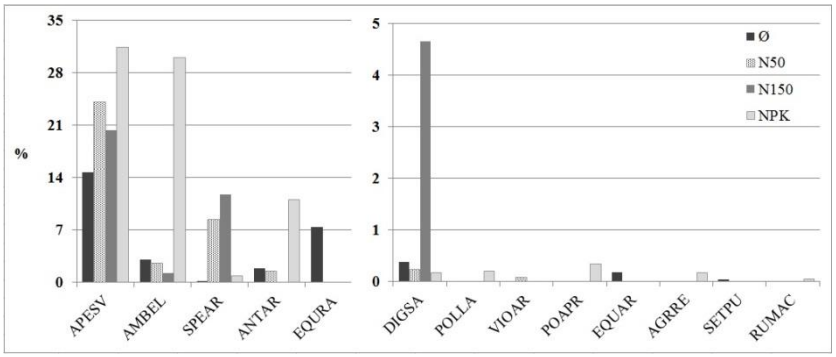

Figure 1. Cover of weed species in the different nutrient treatments

The opposite effect was observed in the case of *A. artemisiifolia* because the soil acidifying effect of nitrogen is less tolerated by this species, which is supported by the fact that it is a slightly baziklin species and rarely occurs in strongly acidic biotopes (*Table 2, Figure 2*). However *A. artemisiifolia* coverage increased significantly in the NPK treatment, which may be related to its preference of nutrient-rich habitats.

Table 2. Frequency and density of weed species on the experimental plots in 2013

No	Weed species	Bayer code	Freq.	Density (plant m^{-2})			
				Ø	N_{50}	N_{150}	Average
1.	*Apera spica-venti* (L.) P. B.	APESV	9	93.3	100.0	147.3	113.56
2.	*Digitaria sanguinalis* (L.) Scop. *	DIGSA	8	14.0	8.0	144.7	55.56
3.	*Ambrosia artemisiifolia* L.	AMBEL	7	52.0	24.7	17.3	31.33
4.	*Spergula arvensis* L.	SPEAR	5	1.3	38.0	65.3	34.89
5.	*Anthemis arvensis* L.	ANTAR	5	8.0	12.0	0.0	6.67
6.	*Viola arvensis* Murr.	VIOAR	2	0.0	1.3	0.0	0.44
7.	*Equisetum ramosissimum* L.	EQURA	1	46.0	0.0	0.0	15.33
8.	*Equisetum arvense* L.	EQUAR	1	2.0	0.0	0.0	0.67
9.	*Setaria pumila* (L.) P. B.	SETPU	1	1.3	0.0	0.0	0.44
	Total ($LSD_{5\%}$: 166.15)			218.0	184.0	374.7	258.9

*Significant differences in weed cover among the treatments (DIGSA $LSD_{5\%}$:111.98)

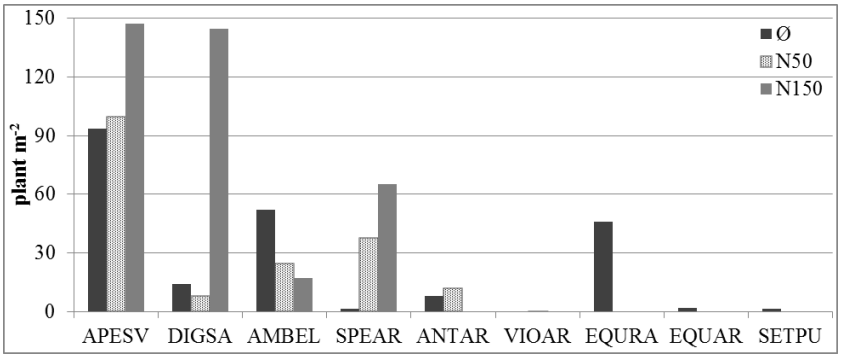

Figure 2. Density of weed species in the different nutrient treatments

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The density and coverage of *S. arvensis* favoring acid sand soil significantly improved with the increasing nitrogen doses, but in the combined treatment its coverage dropped below 1%. *Anthemis arvensis* L. did not occur in plots treated with high doses of nitrogen, whereas in NPK treatment its coverage increased more than six times compared to the control plots. *Equisetum ramosissimum* L. formed more than the quarter of the total weed flora on the untreated areas, while on fertilized plots it did not appear similarly to the other *Equisetum* (*E. arvense* L.), what is probably due to the fact that they prefer nutrient-poor soils.

Conclusions

Results of the weed cover studies of a long-term field experiment with triticale monoculture shows that among favourable conditions even a single weed species can result in a very high weed cover in a crop culture, such as *A. spica-venti* in this recent study. Increasing doses of nutrient treatments resulted in statistically significant increase in both the total weed cover and the number of individuals. On NPK treated plots where weed cover was 74.1%, which was 2.7 times more compared to the control treatment which was 27.6%. It is also concluded, that the *E. ramosissimum* occurred only on the non-treated area, the *S. arvensis* and *D. sangvinalis* was considerable only on the nitrogen-treated plots, while *A. spica-venti, A. arvensis* and *A. artemisiifolia* could proliferate better in the NPK treatment.

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