

EFFECT OF NITROGEN AND PESTICIDES ON THE YIELD AND WEED FLORA OF WINTER WHEAT

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Introduction

The significant effect of weeds is needless to say. Agrotechnical, mechanical and chemical methods are commonly applied in order to control weeds (*Berzsenyi, 2000; Hunyadi et al., 2000*). The extensive use of herbicides has a significant environmental hazard and it can be a yield limiting factor as well, even if herbicides are used inexpertly (*Jolánkai et al., 1998*). Beside herbicide application soil tillage is also a very effective method for controlling weeds (*Tóth and Lehoczky, 2003*). In addition the significant role of nitrogen fertilization in weed control has also been reported (*Lehoczky, 1995*).

In this paper the effect of fertilizer and pesticide application on weed infestation and on grain yield of winter wheat was studied in a bifactorial field experiment.

Methods

The study was conducted in a field experiment set up by the Institute of Plant and Environmental Sciences of the Georgikon Faculty of the University of Veszprém, Keszthely (Hungary). The bi-factorial trial was arranged in split plot design with three replications. The soil was a Ramann-type brown forest soil (Eutric Cambisol) containing 41% sand, 32% silt, and 27% clay. The available phosphorus content of this sandy loam soil was low (AL- P_2O_5 : 60-80 mgkg⁻¹), the potassium content medium (AL- K_2O : 140-160 mgkg⁻¹) and the humus content fairly low (1.6-1.7%), with a pH_{KCl} value of 7.3. Long-term annual mean precipitation is 650 mm, but the distribution is often unfavourable. In this crop year the rainfall during the vegetation periode of the winter wheat was 458,7 mm, which is close to the long term average value (488 mm).

In the experiment the effect of different rates and application methods of N fertilization as well as different variants of pesticide application was studied.

Pesticide treatments:

Ch0: Control

Ch1: Herbicide

Ch2: herbicide+fungicide

Ch3: herbicide+fungicide+insecticide

Fertilizer treatments:					
	N			P ₂ O ₅	K ₂ O
	autumn	Spring1	Spring2		
N ₀	0	0	0	0	0
N ₁	0	40	0	100	100
N ₂	40	40	0	100	100
N ₃	40	40	40	100	100
N ₄	40	60	60	100	100

The study was conducted on the winter wheat in 2004. The previous crop of winter wheat was also winter wheat. The weed flora was recorded two times (20th May and 20th June 2004) by the method of Balázs-Ujvárosi. Analysis of variance was used to test the statistical significance of the treatments.

Results and discussions

The experimental treatments – both the increasing rate of fertilizers and the increasing intensity of pesticide application – had significant effect on the grain yield of wheat (Figure 1. and Table 1.).

In case of fertilizer application each N rates resulted in a further significant yield increase when averaged over the pesticide application. The highest level of N fertilization resulted in more than 100% extra yield compared to the results of the control plots (N₀ mean: 3,11-N₄ mean: 6,47 t ha⁻¹).

The increasing intensity of pesticide application resulted in also a significant yield increase, but not to such a great extent as the fertilization did (12% when averaged over the fertilizer treatments). The Ch3 treatment did not result in a further significant yield increase comparing to the Ch0, Ch1 and Ch2 treatments.

The fertilization×pesticide interaction was also significant on the probability level of 1% resulting in 4,17 t ha⁻¹ yield increase in case of the highest yield (6,74 t ha⁻¹) compared to the absolute control plots (2,57 t ha⁻¹).

The number of weed species was larger (19 on the control, 10 on the Ch1 plots) when the weed flora was recorded for the first time (20 May 2004), while for the second occasion (20 June 2004) it was smaller (9 on the control, 3 on the Ch1 plots).

When the weed flora was recorded for the first time (20th May 2004) the amount of weeds was not great on the Ch1 plots and N application had no significant effect, while on the control plots the largest rate of N fertilizer (N₄ treatments) resulted in a significant increase (Figure 2. and Figure 3.).

For the second scouting time (20 June 2004) as the stand of the crop became stronger the amount of weeds generally increased in most of the treatments except the N₄×Ch0 plots, presumably due to the stronger stand and competitiveness of the crop in this treatment. The effect of the experimental treatments on the weed cover values is not clear either on the herbicide control (Ch0) plots or in the Ch1 treatment. The reason for this was mainly the change of the composition of the weed flora, because the perennial *Convolvulus arvensis* become the dominant species by this time with its vegetative propagation.

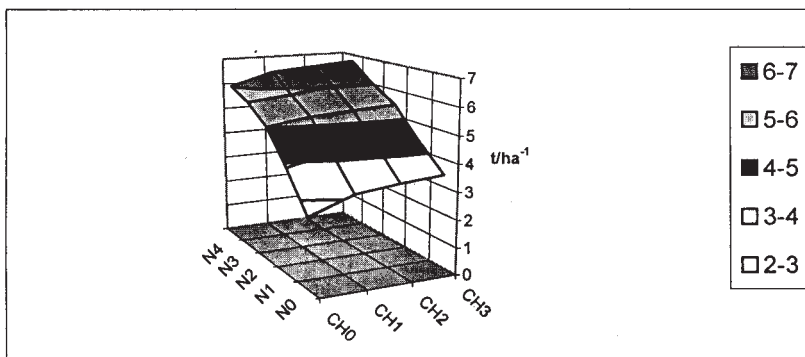


Figure 1. Grain yield of winter wheat as effected by the increasing rate of fertilizers and the increasing intensity of pesticide application (Keszthely, 2004)

Table 1. The significance of the experimental treatments on the grain yield of winter wheat (tha^{-1})

	Ch0	Ch1	Ch2	Ch3	Mean
N0	2,571	3,133	3,310	3,436	3,112
N1	3,868	4,215	4,333	4,358	4,193
N2	5,023	5,24	5,348	5,431	5,260
N3	5,641	5,815	6,051	6,011	5,879
N4	6,021	6,495	6,625	6,743	6,471
Mean	4,625	4,980	5,133	5,196	4,983

$SD_{5\%}$ between combinations=0,25

$SD_{5\%}$ between the variants of fertilization when averaged over the pesticide application=0,11

$SD_{5\%}$ between the variants of pesticide application when averaged over the fertilization =0,13

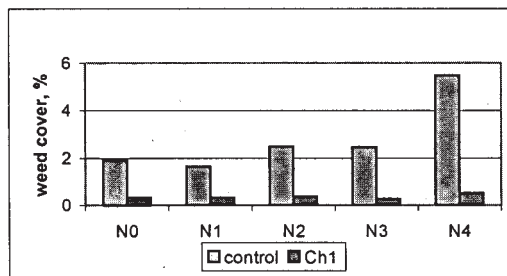


Figure 2. Total weed cover values as effected by the increasing rate of fertilizers and the herbicide application (Keszthely, 20 May 2004)

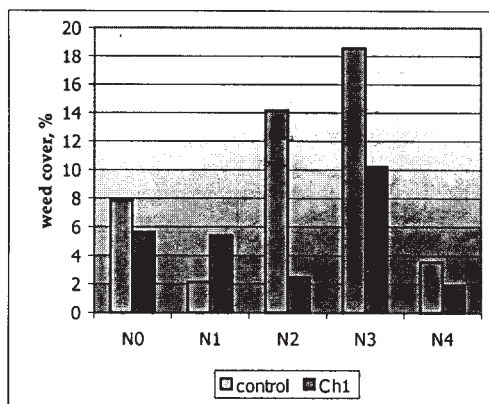


Figure 3. Total weed cover values as effected by the increasing rate of fertilizers and herbicide application (Keszthely, 20 June 2004)

Conclusions

The experimental treatments had significant effect on the grain yield of wheat. N0×Ch0 combination resulted in the lowest, while N4×Ch3 combination the highest yield.

The number of weed species was larger when the weed flora was recorded for the first time, while for the second occasion it was smaller. With the change of the composition of the weed flora by the second scouting time the amount of weeds generally increased in most of the treatments.

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