

Tab. 1: Yield parameters from final yield analysis after applied water stress (K – watered plants, S – stressed plants, HS – main stem, ODN – tillers, SI – stress index)

Cultivar	Var.	Part of a plant	Grain number in aver. ear		% reduced grain number	Grain weight in an aver. ear in (mg)	SI (%)
			forming	reduced			
Kompakt	K	HS	20,12	4,18	17,19	802,2	-
		ODN	17,06	7,94	31,76	644,8	-
	S	HS	17,64	3,33	15,87	600,2	0,748
		ODN	13,47	6,9	33,87	329	0,51
Dobla	K	HS	18,48	12,92	41,14	239,8	-
		ODN	27,83	29,75	51,66	188,1	-
	S	HS	14,77	15,08	50,51	196,9	0,821
		ODN	11,75	17,46	59,77	123,2	0,625
Albacette	K	HS	11,66	4,23	26,62	159,9	-
		ODN	10,32	7,36	41,62	77	-
	S	HS	3,8	29,8	88,69	37,4	0,232
		ODN	-	-	-	-	-

THE INFLUENCE OF THE WEED INFESTATION AND COMPETITION UPON THE WINTER WHEAT YIELD IN RELATION TO DIFFERENT FERTILIZER LEVEL

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Summary

Weed infestation is one of the negative factors, which influences a success of crop production in our agriculture. As regards to diversity and flexibility factors, a determination of weed harmfulness is very difficult.

The weed infestation and competition was observed in winter wheat field trials at 5 different fertilizer levels at the Research Station in Vysoka nad Uhom, the Eastern Slovakia, in 1995-1997. The alluvial soil type and arid condition are typical for crop production in this area in the East-Slovakian Lowland. There were used the winter wheat variety HANA and its seedrate 5 million germinating grains per hectare were used. The weed infestation was observed before the stand harvest and the 9 points EWRS Scale was used.

As far as the decrease of fertilizer level is concerned, an average of weed infestation and weed range were going up. The weed density caused the unfavourable decrease of competition and its grain yield. The middle and strong negative correlation, respectively ($r = -0,60$), is typical between the winter wheat yield and weed density on this crop stand. The variability of weed infestation influenced in average more than 40 % of crop variability in average. These dependences were statistically significant at the level from 1,2 - 1,3 %.

Introduction

The decrease of the yields at middle or strong weediness can achieve more than 30 %. The yields losses can achieve 90 % at the weediness (TYR, 1995).

The plant nutrition is the base of competition ability. It was conclude that the trend towards lower level of nitrogen fertilizer application concerning the environment will the favourable for most of the weed species and the composition of the weed populations (WILSON 1986, DAVIES 1987, KUDSK 1989, DYCK et al. 1995).

By BENADA and VANOVA (1985) it is necessary to be real, that relationships between harmful occurrence of weed and crops yields are considerably variable and depend on many factors. Therefore the expression of harmfulness can not be constant, but it must be a range of values, which is responsible for the changeability of actual factor.

The aim of this work is to document the intensity of late summer weed infestation on winter wheat stands in the dependence on intensity of nutrition after using of herbicide in the cropping. The quantification of the influence of weediness with interaction with the different nutrition levels on the yields of winter wheat is the next element.

Materials and methods

We solved the problems of the winter weediness in the stationary system of crop rotation. The field trial was established in the experiment working place of OVUA Michalovce in Vysoka nad Uhom on the alluvial soil in the conditions without irrigation, 107 m above sea-level. The locality is situated in the central part of East-Slovakian Slowland. A continental climate is characteristic for this region.

The soil composition is sandyloam - loam, according to the performed analysis in 1997 the average humus content was 2,1 %, pH/KCl 6,7, the changeable sorption capacity 24,9 mmol.100 g⁻¹. In climatic point of view the locality is situated in warm, middledry-dry area with the average annual temperature 9 °C and the average temperature in vegetation period 15,2 °C. The long-term average of annual rainfall average is 557 mm and in the vegetation period 397 mm. The information about atmospheric conditions during experiment was obtained from the local meteorological observation station and is included in the enclosure.

The intensity of secondary weediness was studied with 10 models of 5 part crop rotation with 5 repetitions, which was divided spatially and timely.

RINIK et al. (1997) presented the concrete description of this locality, agrotechnics, including the herbicide protection.

The winter wheat variety HANA was used in the experiments. The seeding amount was 5 million of germinating grains per hectare. The distance between the lines was 125 mm. The weed infestation and competition was observed in winter wheat small-plot field trials under 5 different levels of fertilization. The liming and protection was everywhere the same.

Characteristic of preparations:

BIOSIL: the organic-mineral mixture made on the basic dairy by-products. It is ecologically pure. It increases natural soil fertility and promotes development of vegetative and generative plant organs.

ZEOMIX: mixture of NPK and further trace elements: B, Mo, Ti, Fe, Mg, Ca and activ zeolit mineral - klinoptilolit. The content of the mentioned zeolit in the preparation was 36-42 %.

Nutrition at the variants: (in kg p.n.NPK.ha⁻¹, Zeomix, Biosil in kg.ha⁻¹, rate of manure (MH) and of lime CaCO₃ in t.ha⁻¹)

Variant	N	P	K	Zeomix	Biosil	CaCO ₃	MH*
I.	105	55	100	-	-	6	40
II.	(13,5)*	(9)**	(9)**	150	-	6	40
III.	-	-	-	-	-	6	40
IV.	-	-	-	-	150	6	40
V.	-	-	-	-	-	6	-

* - manuring and liming once a 5 years at the beginning of the crop rotations

** - elements in Zeomix

The weed infestation was evaluated according 9 points of EWRS scale a week before the stand harvest. The following weed species were recorded: agropyron repens, echinochloa galli, avena fatua, apera spica-venti, chenopodium album, cirsium arvense, convolvulus arvensis, anthemis arvensis and polygonum persicaria. The total weediness was especially registered. The obtained authentic data were mathematically prepared and statistically evaluated with the regression analysis.

Results and discussion

The average weediness of the winter wheat stands was in the evaluated 3 years period at relatively low level 3,42 p. WILSON and WRIGHT (1990) indicated a good competition ability of the winter wheat. They ascertained that on the stand with the dense wheat the majority of vegetative weeds were suppressed. CERNUSKO (1991) saw the reason for good competition in complete, quick growth, mighty and aleopaty.

The absolute weediness and occurrence of weed species was very variable in the individual years. The highest weed infestation was observed in 1997 and the lowest in 1996. RINIK and HNAT (1990) ascertained a very important role of beginning of sprouting in regard to the wheat weediness. In the case that it begins in the spring the wheat ability of competition is significantly decreased. The most variable weed was avena fatua. One of the important factors, which is determinate by deferences on absolute weediness and occurrence of avena fatua are (KOHOUT and ZAHRADNIKOVA, 1995) the differences in the weather when spring coming. The higher weediness is excepted in the year with early spring when the period with the low temperature as a rule coming. The stands are completed slowly and weeds have beter chance to compete.

The most frequent weeds were agropyron repens, convolvulus arvensis, avena fatua and anthemis arvensis. Agropyron repens occured during 3 years of investigation in 25 % cases. Second most frequent weed was convolvulus arvensis in 19,7 % cases. Avena fatua in 16 % cases and anthemis arvensis in 16 % cases was the further very frequent weeds. The occurrence was relatively low of cirsium arvense 5,7 % polygonum persicaria 2 %, equisetum arvense 1,7 % and chenopodium album 1 %. The winter weed apera spica-venti and summer weed echinochloa galli were not recorded in the winter wheat. As far as the group of other weeds with the occurrence of 14 % is concerned the most frequently occurring and economically low important species were anagallis arvensis and some kinds of veronica.

Agropyron repens belong to cosmopolitan weeds (HRON, KOHOUT 1986, WHITEHEAD, WRIGHT 1989). COUDNEY et al. (1991) wrote, that the relative low avena fatua infestation wheat had a significant influence on the light penetration and wheat yields.

It was evident a different weediness of variants. In 3 year average we obvious higher weed infestation on the first variant than on the second one. RICHARDS (1993) ascertained the highest weed infestation in N-highest plots in the wheat variety trial. It was concluded that a trend towards the lower application of nitrogen fertilizer concerning the environment will be favorable. It is concerning also for the most of the weed species, and composition of weed populations (WILSON 1986, DAVIES 1987,

KUDSK 1989, DYCK et al. 1995). The weediness of first, fourth and fifth variants increased with the decrease of nutrition. The third variant belongs between the first and the second one regarding the weediness.

Our data about min., max., aver. Weed infestation on variants implicitly indicated the different wheat competition in different nutritional conditions according to RICHARDS (1989) intention, that higher crop covering caused lower weed coverage. The decrease of weed covering in dependence on wheat covering increase was observed by WRIGHT (1993) in conditions of different nutrition and seedrate too.

The attained wheat yields were in 3 years salvation in the wide interval from middle to strong correlation with weediness, on every variants. These relationships were variable by years and nutrition variants and are in space from weak to very strong correlation. The hyphen of corr. coefficient was right as regards to economical interpretation and the type of regression and the weed infestation.

We find the strongest relationship between weed coverage and achieved wheat yields on fifth, nonmanured variant. The variability of weediness caused 41,92 % changes in the variability of the wheat at this variant. We observed the lowest dependence at the variant with the application of Biosil as far as the evaluated variants are concerned. The changes in weediness variability caused 13,06 %, variability of the wheat yields. It is clear from Tab.3, that the weed harmfulness at the first, the fourth and the fifth variant increased with the decrease of nutrition. The relationships between yields and weediness at the first and second variant are approximately the same. The statistical parameters were variable on every variant according to year. As regards to the mentioned facts we observed the significant influence of weediness on the decrease of the yield of winter wheat. The decrees of the nutrition intensity cause a scale of weediness with the parallel increasing of economical weed harmfulness. It is responsible with CAUSSANEL et al. (1996) confirmation, that weed competition significantly influenced winter wheat yields in despite of parallel wheat yield increasing in conditions of nutrition range intensity. We observed the weediness decreasing in comparison by the first and the second variant, what was confirmed by corresponding literature (JORNsgARD et al., 1996).

We represented the functions of achieved wheat yields on stand weediness on the Fig.1. The x-axis is determined by real values.

Our conclusions are corresponding with confirms in literature (SALONEN 1992, WRIGHT 1993, LINTELL-SMITH et al. 1992). FUCHS and SCHMIDT (1993) by who weed and crop competition is significantly influenced by fertilization. By JORNsgARD et al. (1996) nutrition is the base of crop competition ability. Our results that weed competition significantly influenced winter wheat yields, despite of parallel yields increasing at conditions of the increase of nitrogen. confirmed also CASSANEL et al. (1996). We are agree also with ZANIN et al. (1993), that without information about nutrition it is impossible to calculate an economic threshold for some of the treatments which could not be economically justified.

References

- BENADA, J. - VÁŇOVÁ, M.: K problematice prahu škodlivosti u plevelu a chorob obilnin. Úroda, 1985, è.2, 56-58.
- CAUSSANEL, J.P. - ANGININ, C. - MEYNARD, J.M.: Competition of some species in winter wheat, in relation to production constraints. Seizieme conference du COLUMA. Journees internationales sur la lutte contre les mauvaises herbes, Reims, France, 1996, 337-345
- ČERNUŠKO, K.: Ekologické pristupy k regulácii zaburinenosti. In: Ekologické zásady hospodárenia na pôde. Nitra VŠP, 1991, s.98-106
- DYCK, E. - LIEBMAN, M. - ERICH, M.S.: Crop-weed interference as influenced by a leguminous or synthetic fertilizer nitrogen source: I. Doublecropping experiments with crimson clover, sweet corn, and lambsquarters. Agriculture, Ecosystems and Environment. 1995, 56:2, 93-108
- HNÁT, A. - RINÍK, E.: Intenzita zaburinenia v závislosti od koncentrácie hustosiatych obilnín a kukurice. In: Zborník vedeckých prác. Michalovce, PVIP, 10, 1990, 141-152
- HRON, F. - KOHOUT, V.: Polní plevel - část obecná. Praha, SZN 1986, 168
- HRON, F. - KOHOUT, V.: Polní plevel - metody plevelářského výzkumu a praxe. Skriptum. Praha, SPN, 1967, 223
- JORNsgARD, B. - RASMUSSEN, K. - HILL, J. - CHRISTIANSEN, J.L.: Influence of nitrogen on competition between cereals and their natural weed. Weed Research, Oxford, 1996, 36:6, 461-470
- KOHOUT, V. - ZÁHRADNÍKOVÁ, H.: Zaplevelení obilnin ve vztahu k pøedplodinám. Rostlinná výroba. Praha, 41, 1995, è.6, s.259-262
- KUDSK, P.: Experiences with reduced herbicide doses in Denmark and the development of the concept of faktoradjusted doses. Brighton Crop Prot. 1989, 545-554
- LINTELL-SMITH, G. - BAYLIS, J.M. - WATKINSON, A.R. - FIRBANK, L.G.: The effect of reduced nitrogen and competition on the yield of winter wheat. Aspects of Applied Biology. 1992, 30, 367-372
- RICHARDS, M.C.: Crop competitiveness as an aid to weed control. Brighton Crop Protection Conf., 1989, 573-573
- RICHARDS, M.C.: The effect of agronomic factors on competition between cereals and weeds, the implications in integrated crop production. Brighton crop protection conference, weeds. Proceedings of an international conference, Brighton, UK, 1993, 3., 991-996
- RICHARDS, M.C.: Crop competitiveness as an aid to weed control. Brighton Crop Protection Conference, 1989, s.573-578
- RINÍK, E. - TÓTH, Š.: Stacionárne sústavy striedania plodín. Výskumná správa. OVÚA Michalovce, 1996
- TÝR, Š.: Vplyv sústav hospodárenia na zaburinenosť porastov pestovaných plodín. (Doktorandská dizertačná práca). Nitra, 1997, 206 s., VŠP AF.

WRIGHT,K.J.: Weed seed production as affected by crop density and nitrogen application. Brighton crop protection conference, weeds. Proceedings of an international conference, Brighton, UK, 1993, 1., 275-280
WRIGHT,K.J. - WILSON,B.J.: Effects of nitrogen fertilizer on competition and seed production of *Avena fatua* and *Galium aparine* in winter wheat. *Aspects of Applied Biology*. 1992, 30, 381-386
WILSON,B.J.: Yield responses of winter cereals to the control of broadleaves weeds. *Proc. EWRS Symposium - Economic Weed control.*, 1986, s.75-82
WILSON,B.J. - WRIGHT,K.J.: Predicting the growth and competitive effects of annual weeds in wheat. *Weed Res.*, 30, 1990, 201-211
ZANIN,G. - BERTI,A. - TONIOLO,L.: Estimation of economic thresholds for weed control in winter wheat. *Weed Research Oxford*, 1993, 33:6, 459-467

