Table 3 Average number of weeds per m^2 in winter wheat in 1998 and 1999

Weed species	***Spring aspect***						***Summer aspect***					
	SEBECHLEBY		***PLAVÉ VOZOKANY***		***Dačov Lom***		***SEBECHLEBY***		***PLAVÉ VOZOKANY***		***Dačov Lom***	
	Eco.(1)	*Con.(2)*	*Eco.*	*Con.*	*Eco.*	*Con.*	*Eco.*	*Con.*	*Eco.*	*Con.*	*Eco.*	*Con.*
AMARE	-	-	-	-	-	0,5	-	-	-	-	-	-
ANTAR	-	-	2,0	3,7	18,2	4,9	13,1	-	-	1,4	4,3	2,2
APESV	-	-	-	-	-	-	1,4	-	-	-	2,2	0,8
ATRPA	-	-	-	-	1,2	-	-	-	-	-	0,3	-
AVEFA	-	-	-	-	2,1	0,6	-	-	-	-	-	-
BRAOL	-	1,6	-	-	-	-	-	-	-	-	-	-
CAPBP	-	-	0,3	0,7	0,3	0,1	-	-	-	-	0,6	0,2
CARDR	-	-	-	1,4	0,6	1,6	-	-	-	-	-	-
CICHI	-	-	-	-	0,1	0,2	-	-	-	-	-	-
CIRAR	4,7	-	3,0	3,4	0,1	0,2	11,2	0,2	4,2	3,4	4,9	1,5
CONAR	-	-	-	-	14,0	1,4	3,3	0,1	-	-	2,6	0,3
EROCI	-	-	-	-	0,2	-	-	-	-	-	-	-
EQUAR	-	-	-	-	-	-	-	-	-	-	0,1	0,4
FALCO	-	-	-	-	0,7	0,3	-	-	3,1	-	1,7	0,1
GAETE	-	-	-	-	-	0,1	-	-	-	-	-	-
GALAP	0,1	-	0,2	-	0,3	2,0	-	-	-	-	0,4	0,2
CHEAL	-	-	0,5	-	19,7	5,9	-	-	-	-	-	-
LAMPU	-	-	-	4,1	-	-	-	-	-	-	-	-
PAPRH	-	-	0,2	0,1	-	-	-	-	-	-	-	-
PERMA	-	-	-	-	13,6	0,6	-	-	-	-	-	-
POLAV	-	-	3,0	-	2,8	1,1	0,1	0,6	5,4	-	1,9	1,4
RAPRA	-	-	-	-	0,4	-	-	-	-	-	-	-
RUMCR	-	-	-	-	0,1	-	-	-	-	-	-	-
STEME	-	-	-	8,6	-	0,1	-	-	0,1	2,9	0,1	0,5
TAROF	0,1	-	-	0,2	-	-	-	-	-	-	-	-
VERAR	0,2	-	3,3	0,4	3,4	7,7	-	0,5	-	0,8	-	1,4
VIOAR	-	-	-	11,3	0,3	0,4	-	0,3	0,4	4,4	0,4	1,6
Total	5,1	1,6	12,5	33,9	78,1	27,7	29,1	1,7	13,2	12,9	19,5	10,6

References

HRON, F. – VODÁK, V. 1974. Polní plevele – metody plevelářského výzkumu a praxe. Praha: SPN, 1974, 223 p
LACKO-BARTOŠOVÁ, M. et al. 2000. Weed seedbank in ecological and integrated farming system. In: Rostliná výroba, 7, 2000, p. 319-324

SUSTAINABLE CEREAL PRODUCTION IN HUNGARY

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Strongly simplifying we could distingues two agricultural models nowadays: conventional and alternative (sustainable). In the alternative agriculture we could reach the sustainability (from ecological, agronomical and economical aspects) by taking greater roles and advantages of the biological interactions and natural cycles that are already at work or available to work on the farm. Beacuse of the differences of ecological and economical circumstances there is no intrinsically correct way to proceed, so alternative (sustainable) agriculture requires different practices, methods, cropping systems etc.
The different agricultural models could be adequate individually from different aspects (agronomical, environmental, economical, social etc aspects). Although many production systems may pass the rigors of environmental protection, economic security and social acceptibility individually, few are satisfying all the facets necessary for a successful agriculture. Sustainable agriculture could be such an agricultural system.

In sustainable crop production it is very important to know precisely the agroecological conditions of crop management. Within that we have to study the climatic, soil, geographical conditions, we have to adapt the crop management to the agroecological conditions (site-specific models), and we want to avoid the environmental pollution in different agroecosystems. In the field of biological-genetic factors we have to improve the biodiversity, to breed new genotypes and we have to integrate the biological and agrotechnical elements (variety-specific technologies).
In sustainable agriculture we have to increasingly rely on the interactions among the different agrotechnical elements. The fertilization plays a central role in the agrotechnical elements of sustainable agriculture (direct and indirect effect of fertilization). Reducing external, industrial inputs is also an important issue.
In the sustainable agricultural system we have to improve the usage of interactions among agroecological, biological ang agrotechnical factors.
The crop quality and its improvement has also a central role in this system.
We have to keep in our mind that every production system should be economically viable which need some governemental and other market helps and preferences.
It is also very important that the society should accept the programme and methods of sustainable agriculture. It means not only an increasing and special demand of good quality and healthy food, but a special thinking of the majority of society concerning the farming practice (energy-saving, low-input methods etc.) and concerning the environmental protection (to avoid, not ameliorate the pollutions in the agroecosystems).
We are sure that we have to change our thinking about the principles of crop production (for example in wheat management). In the past we wanted to carry out, to make the optimum values of different agrotechnical factors, because our main aim was to obtain the maximum yield. The quality of crops had less importance. At present and in the future we want to carry out the necessary minimum values of many agrotechnical elements and to make optimum values of some critical factors (like fertilization etc.) to obtain optimum yield with good quality of crop products.
Theoretically in the sustainable crop management different technologies could be (extensive, low-input, mid-tech, intensive) but in our (Hungarian) conditions we can use widly two technologies: low input and mid-tech.
In our polifactorial research project we study the different crop management models in wheat production. The table 1. shows good results with the using of appropriate technological elements (in the cases of LISA and mid-tech [b] we got the same yields [7 t/ha] as in the case of intensive model). The economical efficiency and environmental pollution are strongly higher in intensive model, than in mid-tech or LISA models.

Table 1 Different crop management models in winter wheat production

Crop model	Forecrop	Genotype	Planting mode	Plant production	N-fert. (kg/ha)	Yield (kg/ha)	Yield difference	
							(kg/ha)	%
Extensive	w.wheat	Mv 15	normal	conventional	0+0	4217	0	100,0
LISA	peas	Fatima 2	new	env.friendly	30+0	6958	2741	165,0
Mid-tech(a)	w.wheat	Fatima 2	new	conventional	30+30	4912	695	116,5
Mid-tech(b)	peas	Mv 15	normal	env.friendly	30+30	6895	2678	163,5
Intensive(a)	w.wheat	Mv 15	normal	conventional	60+30	5470	1253	129,7
Intensive(b)	peas	Mv 15	normal	conventional	30+30	7017	2800	166,4

Among the production elements fertilization has central and integrated role on the increasement of agronomic and economic efficiency and on the environmental hazards and protection in wheat production. Our long-term experimental results pointed out that the average-yield without fertilization (control) was 4439 kg/ha and we obtained fairly good yield surplus (2162 kg/ha in average) with the application of optimum doses of NPK fertilizers (average yield was 6601 kg/ha). This good extra-yield was obtained on chernozem soil characterised by excellent natural physical, chemical and nutrient-supply characteristics.
In extreme (like continental) climatic conditions it is very important to reduce, to minimise the harmful climatic effects on crop (wheat) production. With the appropriate fertilization and the precise application of other agrotechnical elements we could reduce the unfavourable effects of ecological factors. Our scientific results pointed out that the optimum fertilization could increase the yield stability. In control treatment the fluctuation interval of yield was much higher (71 %) than in the optimum fertilizer application (48 %). The appreрriate fertilization could increase the water-utilisation of crops (wheat). In optimum fertilization the yield-surpluses per one unit precipitation in different periods of vegetation time were much higher comparing with control coefficients (in control 8-20 kg mm^{-1} rainfall, in optimum NPK doses 15-28 kg mm^{-1} rainfall).
Our long-term experiments proved that the optimum doses of NPK fertilizers (mainly N) and the efficiency of fertilization were affected by not only ecological factors (cropyear, soil) but were strongly modified by agrotechnical elements.
In harmonised fertilization (NPK and others) the most important element is nitrogen because of its very active role in the physiological processes in plants and its special mineralizations in soils. Our long-term experimental results proved that the optimum N-doses varied from 60 kg/ha to 120 kg/ha on chernozem soil depending on cropyears, agrotechnical elements and genotypes. For the determination of fertilizer responses of different wheat genotypes we used the following parameters:

- natural nutrient utilisation (yields in control treatment)
- specific fertilizer utilisation (yield-increasement per unit NPK)
- maximum yield in optimum fertilizer treatment
- optimum fertilizer dose (N+PK)
- fertilizer response curves

Our long-term experimental data proved that on the basis of the nutrient-utilisation, -demand and fertilizer response of different winter wheat varieties the varieties can be divided into 4 types (figure 1.).
Type A is a modern genotype regarding fertilizer response (it combines extensive and intensive nutrient-utilisation traits), type B is an extensive genotype (it has strong very good utilisation of natural nutrient resources), type C is a traditionally intensive genotype (which means that this type needs bigger fertilizer doses) and type D is an out-of-date genotype (it could be characterised by weak natural nutrient utilisation and weak fertilizer response).
With the application of variety-specific fertilization we could increase not only the yield and agronomic efficiency of wheat production but we could manifest the quality-potential of genotypes.

Figure 1. Types of fertilizer response in winter wheat varieties (Peter Pepó, 1989, chernozem soil)