

WHEAT BREEDING AND BREADMAKING QUALITY IN AUSTRIA

M. OBERFORSTER and M. WERTEKER

Bundesamt und Forschungszentrum für Landwirtschaft, Wien, Österreich

Federal Office and Research Center for Agriculture, Vienna, Austria

Savezni ured i istraživački centar za poljodjelstvo, Beč, Austrija

SUMMARY

There is an efficient wheat breeding in Austria, four enterprises are intensively occupied winter wheat, the divergent climatic and soil conditions make special demands on the breeding work. Among varieties - mostly awned - suitable for the semiarid Pannonic region essential progress with regard to yields has been achieved, nevertheless maintaining high quality standards. For cultivation in cool and moist regions emphasis of breeding is placed on varieties - mostly awnless - with good, moderate or low bread-making qualities. By cooperating with research institutions biotechnological methods are used increasingly in practical breeding. Wheat varieties are divided into nine (1 to 9) quality groups (BQGs) according to their suitability for baking. Simple inter-varietal correlations between parameters of bread-making quality were demonstrated. Most of the Austrian varieties highly suitable for bread-making (BQG 9, 8 and 7) contain the HMW glutenin subunits Glu-B1 7+9 and Glu-D1 5+10. Varieties with medium or low baking quality mostly have the combination 6+8 resp. 6+8 and 2+12 resp. 7+8 and 2+12.

ACREAGE AND YIELD

Winter wheat covers a cropped acreage of 235.000 hectares (= 17% of the arable area and 36% of the total cereal area); it is the most important cereal species in Austria (Fig. 1). Spring common wheat is grown on about 10.000 hectares, spring durum wheat on 9.500 hectares. This contribution deals only winter wheat.

Austrian average yields increased from 34,5 dt/ha (1970-75) to 49,9 dt/ha (1989-94), thus being positioned clearly below the yield level of Germany, France or other Western European countries. The reasons may be found in a percentage of varieties of quality wheat above the average, in the semiarid climate of the Pannonic region in the Eastern part of the Republic as well as in the modest application of N-fertilizers, growth regulators and/or fungicides. Not more than 40-50% of the quantity harvested is needed for human nutrition. The relative yield of varieties, calculated in the humid climatic zones, shows a difference between 78 (Erla Kolben) and 116 (Contra).

WHEAT BREEDERS IN AUSTRIA

Innovative wheat breeding is undertaken intensively by three larger private or cooperative enterprises (A, B, C), acting on the international level, as well as by one (D) smaller breeder (Table 1, Table 2). Intensive breeding efforts increased the yield level and

resulted in varieties with essentially more beneficial cropping qualities. The increased yields were reached by a greater number of grains per ear as well as by a higher density.

Table 1. Wheat breeders in Austria
Tabela 1. Oplemenjivači pšenice u Austriji

BREEDER	CEREAL QUALITY RANGE
A) Probst. Saatucht	Winter-wheat (high medium and low bread- making quality) Spring- and Winter-Durum
B) Saatbau Linz	Winter-wheat (high medium and low bread-making quality)
C) LFS Edelhor	Winter-wheat (high medium and low bread- makingquality) Spring-wheat
D) Saatucht Piatti	Winter-wheat (high bread-making quality)
E) Satbau Neuhof	Winter-wheat (no new crossings)
F) BVW Wieselburg	Winter- and Springwheat (no new crossings)
G) Kamtner Saatbau-genossenschaft	Winter- and Spring-wheat (no new crossings)

GENETIC SOURCES

The Pannonic region is characterized by low winter temperatures without a sufficient snow cover, by poor precipitations (450-600 mm annually) and by hot summers. Quality wheat - prevailing awn-varieties - is predominantly grown in this area since several decades. The Austrian wheat-type for this region is characterized by a strong tillering tendency, medium or tall plant height, very early or medium ear-emergence and maturity, a pyramidal or tapering ear, a laxor medium ear-density and tolerance against drought. The early genetic sources were of Hungarian ("Tisza wheat"), Roumanian, Russian ("Bezostaja 1"), German ("Merlin", "Format"), French("Bleu Dome") and American ("Thatcher") origin (1). Wheat varieties from Western Europe are scarcely adapted to the specific climatic conditions of Eastern Austria and show unreliable yields. The lodging resistance, originally unsatisfactory with varieties such as Loosdorfer Austro Bankut, Stamm 101, Record and Extrem, has reached with the cvs. Amadeus, Brutus, Capo, Georg, Josef and Leopold a medium or good level, sufficient in most years. A hard glassy grain with high water uptake ability of the flour is a special feature of these genotypes. The most successful parents for Pannonic wheat varieties were Bezostaja 1, Extrem and Pokal (Table 3).

On the moist and transition climatic provinces (Alpine foot hills, Southernparts of Burgenland, Eastern Stvia, Nothern parts of Upper and Lower Austria) 95% of the wheat are awnless varieties (Club-wheat) of good, medium or low bread-making qualities. Besides of domestic sources a good deal of German sources is used. Varieties suitable for these regions need a medium to excellent standing power, a good resistance against leaf rust, head blight and Septoria glume blotch, and a medium to late maturity. Among foreign varieties most successful crossings were carried out with Caribo, Diplomat and Kronjuwel.

Efforts to breed a variety equally suitable for all Austrian cropping sites so far have not been very successful.

M. Oberforster and M. Werteker: Wheat breeding and breadmaking quality in Austria
Sjemenarstvo 12(95)6, str.413-425

Tabela 2. Winter-wheat varieties registered in Austria
Tabaela 2. Priznati kultivari ozime pšenice u Austriji

VARIETY	BREEDERS		BREAD MAKING QUALITY GROUP (BQG)	AGRONOMIC CHARACTERS			DISEASES			YIELD%	
	COUNTRY	SPIKE TYPE		Winter- hardness	Date of heading	Plant- height	Lodging resistance	Powdery - mildew	Leaf rust	Semiarid areas	Humid areas
EXCELLENT TO HIGH BREAD-MAKING QUALITY (BQG 9-7):											
Erla Kolben	AUT	SW	9	7	+5	115	5,5	6	7	85	78
Agron	AUT	AW	8	2	+0	101	8	6,5	5	95	88
Amadeus	AUT	CW	8	4	+5	96	3,5	5	3	100	—
Georg	AUT	AW	8	5	+7	105	4	3,5	5	106	—
Martin	AUT	AW	8	3	+4	108	8	5	4	101	88
Perlo	AUT	AW	8	4	+5	107	7	7	6,5	98	90
Aron	D	CW	7	3	+6	103	5	4,5	8	106	105
Brutus	AUT	AW	7	4	+5	104	5	5	4	102	—
Capo	AUT	AW	7	5	+4	108	5,5	5	2	108	107
Extrem	AUT	AW	7	2	+3	119	9	6	6	93	—
Josef	AUT	AW	7	3	+3	96	3	4,5	4	105	—
Karat	AUT	AW	7	2	+3	113	5	6	5	91	81
Leopold	AUT	CW	7	4	+5	108	4,5	5,5	4,5	108	—
Rektor	D	CW	7	5	+10	107	5	7	6	90	96
Renan	F	AW	7	5	+4	85	2,5	4	2	110	102
GOOD TO LOW BREAD-MAKING QUALITY (BQG 6-3):											
Adam	aut	aw	6	4	+5	91	4	7	5	100	91
Ferdinand	aut	aw	6	4	+6	107	4,5	8	8	95	87
Florian	AUT	CW	6	4	+6	103	3	5	4	—	105
Herzog	D	CW	6	5	+8	98	2	6,5	9	—	99
Lindos	D	CW	6	4	+7	96	4	3,5	3,5	—	107
Silvius	AUT	CW	6	4	+9	101	4	8	6	—	106
Aurus	AUT	CW	5	5	+7	97	2	3,5	5	—	101
Hubertus	AUT	CW	5	5	+8	102	5	4	6,5	—	102
Kontrast	D	CW	5	3	+3	96	2	5,5	6	—	105
Willi	AUT	CW	5	5	+9	105	4	5	5	—	101
Justus	AUT	CW	4	5	+4	96	2,5	8	6,5	—	101
Profit	D	CW	4	5	+7	102	2,5	6,5	8	—	106
Regent	AUT	CW	4	4	+7	102	5,5	7	8	103	94
Ikarus	AUT	CW	3	4	+9	105	2,5	7	7,5	—	103
LOW TO INFERIOR BREAD-MAKING QUALITY (BQG (3) 2-1):											
Atlantis	D	CW	3	4	+10	93	2	7	7	—	104
Apollo	D	CW	2	5	+8	93	2,5	5,5	5,5	—	110
Claudius	AUT	CW	2	7	+6	105	4	5,5	4	—	108
Dominus	AUT	CW	2	4	+7	103	5	6	6	—	112
Contra	D	CW	1	5	+8	89	2	4	3,5	—	116
Hai	D	CW	1	5	+6	109	3,5	6	6	—	110

Breeders contry: AUT = Austria, D = Germany, F = France
Bread-making quality group: 9 = excellent bread-making quality,
1 = very low bread-making quality (scale turned!)
Spike type: CW = Club wheat (awnless), AW = Awn wheat
Scale for winter-hardiness, lodging-resistance: 1 = very high, 9 = very low
Scale for powdery-mildew, leaf rust: 1 = resistant, 9 = highly susceptible
Date of heading: Days after "Agron" (adjusted means)
Plant height, without awns: cm (adjusted means)
Grain yield, adjusted means: dt/ha (14% moisture), semiarid areas 100 = 65,7;
humid areas 100 = 70,5

Table 3. Pedigree of Austria winter-wheat varieties
Tabela 3. Podrijetlo austrijskih kultivara ozime pšenice

VARIETY	REGISTRATION	PARENTS
Excellent to high bread-making quality:		
Erla Kolben	1962	Admonter Früh/Stamm 101
Agron	1981	Neuhof Nr. 1/Artemovka/Bezostaja1
Amadeus	1986	Pokal (Diplomat/Purdue 5517/Diplomat)/Kavkas
Georg	1993	Expert (Extrem/Mexico 40/Neuhof Nr. 1/3/HP 35719)/Severin (Kranich/Diplomat)
Perlo	1979	Extrem/Bezostaja 1
Brutus	1994	Agron/Extrem
Copo	1990	Martin/pokal
Extrem	1968	Record/Brucker Harrachweizen
Josef	1994	Extrem/HP 35719//Pokal/3/Perlo
Karat	1977	Extrem/Bezostaja1
Leopold	1993	Pokal/Karat
Martin	1983	HP 35719/Extrem
Good to low bread-making quality:		
Adam	1977	Neuhof Nr. 1/Bezostaja 1/Produttore
Rerdinand	1983	Firbeck/Tenor//Extrem
Florian	1994	Kronjuwel/3/Pokal//HP 35719/Wxtrem
Silvius	1995	Ikarus/Famulus (kormoran//F 7736 (Merlin/Format)2*/Probus)
Aurus	1993	Kronjuwel/3/Pokal//HP 35719/Extrem
Hubertus	1987	F 7736 (Merlin/Format)2*/Probus//Maris Huntsman
Willi	1993	Brokat (Diplomat/2*Erla Kolben)/Disponent
Justus	1992	Caribo/Multiweia (HAV 34/Heine VII)//W 49/74-14
Regent	1979	Perdix (Merlin/Heine VII)/2* Diplomat
Ikarus	1984	Caribo/St. 623-65
Low to inferior bread-marking quality		
Claudius	1987	Maris Huntsman/3/Weihest. 9//Schernauer/Multiweiss
Dominus	1993	Granada//Caribo//Multiweiss

PRACTICAL BREEDING PROGRAMMES

In Austria about 700 crossings are carried out with winter wheat including reciprocal combinations. At present the principal objectives of the breeding programmes are: yield-capacity, yield-stability, bread-making and milling qualities, lodging resistance and resistances against abiotic (frost, drought, sprouting etc.) and biotic stress-factors such as powdery-mildew, leaf rust, stem rust, *Fusarium* head blight, *Septoria* glume blotch and *Mycosphaerella graminicola*. Nitrogen efficiency and suitability for extensive- farming has become an additional objective of wheat breeding. Introducing cultivars of reduced plant height (*Rht*) is frequently used in breeding programmes to obtain better lodging resistance. Almost exclusively the conventional combination breeding is carried out.

Biotechnological methods such as anther culture, double-haploid techniques and wheat-maize-pollinations are applied on a limited scale (2). Selection is executed predominantly under natural conditions and - as in official VCU-testing - without the application of growth regulators (CCC) and fungicides. Resistance against stem rust, head blight (3) and glume blotch is tested partially by means of artificial infections with suitable isolates and spore suspensions in cooperation with the Institute for Agrobiotechnology and the Institute for Phytomedicine. Sprouting and shattering resistances and winter-hardiness are tested under induced conditions. First quality checks are carried out in the F3- or F4-generation, first yieldtests in the F5- or F6 generation. Efforts to raise yields of quality wheat have led to a certain drop in protein and gluten contents, but rheological characteristics, loaf volume and appearance remained unchanged (Tab. 4)

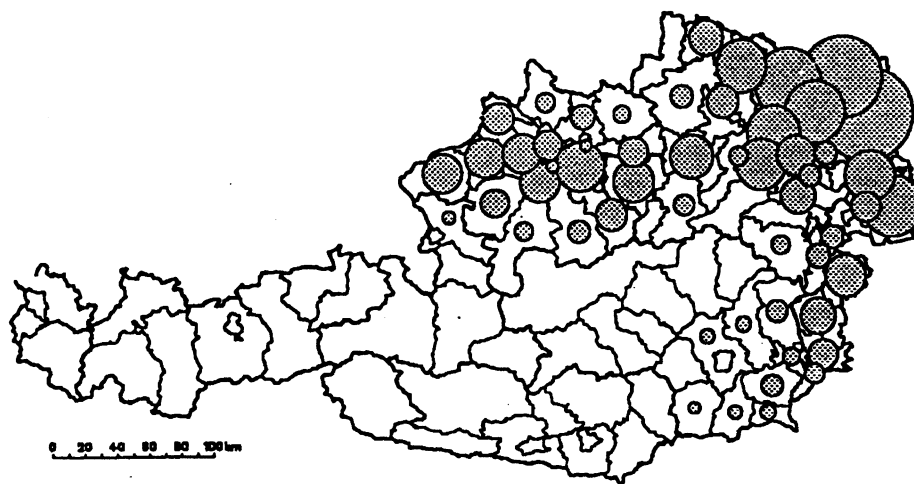


Fig.1. Winter wheat acreage in Austria - 235.000ha
Slika 1. Površine pod ozimom pšenicom u Austiji - 235.000 ha

EVALUATION OF THE BREAD-MAKING QUALITY OF WHEAT-VARIETIES

The varieties have been divided into 9 BQGs, numbered from 1 to 9; 1 representing the lowest quality and 9 the highest. The evaluation - based upon the results of national trials - is made according to four indirect parameters (protein content, wet gluten content, Zeleny-sedimentation value, falling number), three rheological characteristics (quality number from the Brabender-Farinogram, water absorption and dough-area from the Brabender-Extensogram) as well as to the results of the modified Rapid-Mix-Test (Fig. 2, 3). Dough surface, structure and tolerance, sensoric quality of the produced special rolls ("Kaisersemmel") and loaf volume as the most important parameter. For every parameter minimum scoring notes are determined (4). Since 1994 Chopin-alveogram-parameters are used in variety-testing only with regard to export of wheat. The Berliner-Gluten swelling number is no official criterion, it was an important parameter in the past.

Tabela 4. Austria winter wheat varieties - Results of quality official trials 1986 - 1995, adjusted means
Tabela 4. Avstrijski kultivari ozime pšenice - Rezultati ispitivanja kakoće

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
AGRON	8	44,9	79,9	15,2	35,1	20,4	51,4	283	65,4	5,1	7,3	91	79	61,9	191	316	481	1,7	119	616	
AMADEUS	8	44,0	80,0	15,1	33,5	22,0	55,1	332	63,4	5,6	7,9	99	75	59,1	191	357	549	1,9	138	609	
CAPO	8	42,9	82,6	14,1	31,9	20,9	54,1	332	64,3	4,9	6,7	83	80	60,3	192	333	514	1,8	131	588	
GEORG	8	43,4	81,0	13,9	31,0	20,9	50,7	292	63,2	4,9	7,3	87	81	59,5	182	363	536	2,1	129	609	
MARTIN	8	41,0	79,7	13,8	30,4	20,0	48,7	299	61,6	4,3	6,0	73	83	58,2	181	377	562	2,1	134	617	
PERO	8	44,2	81,3	14,5	33,6	20,4	58,6	278	65,6	5,2	7,5	95	78	61,4	193	339	524	1,8	133	607	
BRUTUS	7	45,3	82,9	14,2	32,6	21,3	54,7	343	65,2	5,2	7,6	94	76	60,6	192	322	492	1,7	123	580	
JOZEF	7	44,6	81,4	14,1	32,9	19,5	56,1	303	65,7	4,9	7,0	88	80	61,6	198	313	478	1,6	124	573	
LEOPOLD	7	45,4	80,9	13,8	31,1	21,2	49,3	336	63,7	4,5	6,7	82	87	60,1	186	329	493	1,8	120	689	
ADAN	6	42,1	78,5	13,7	29,3	20,5	48,0	334	60,3	3,6	5,8	69	90	57,0	185	357	499	2,1	118	579	
FLORIAN	6	39,9	79,6	12,8	26,5	19,7	43,2	352	62,2	3,5	6,0	70	87	59,0	166	403	539	2,6	116	553	
SILVIJUS	6	43,1	80,4	12,8	25,5	21,5	47,4	327	62,4	2,9	4,9	58	88	59,1	151	493	599	3,5	114	151	
HUBERTUS	5	50,9	78,7	13,3	29,6	16,4	38,3	278	68,1	3,4	4,3	60	119	63,3	174	285	369	1,8	85	544	
JUSTUS	4	43,2	79,3	13,7	30,7	15,5	37,8	338	62,7	3,3	4,7	61	92	59,3	149	309	356	2,2	71	508	
IKARUS	3	42,1	79,9	13,4	25,1	20,4	26,8	317	57,9	3,2	6,4	71	78	55,2	135	399	468	3,2	82	467	
CLAUDIUS	2	43,7	78,7	12,6	28,8	9,3	21,8	300	59,0	2,3	3,1	40	119	56,8	173	219	253	1,4	56	425	

- 1 Variety
2 Breadmaking quality group (BQG)
3 Thousand kernel weight, g (14% moisture)
4 Hectolitre weight, kg
5 Protein content, %
6 Wet gluten content, %
7 Beliner-Gluten swelling number, ml
8 Zeleny-sedimentation value, ml
9 Falling number (Hagberg), sec
10 Water absorption (farinogram), %
11 Development time, min
12 Stability, min
13 Quality number
14 Softening, FU
15 Water absorption (extensogram), %
16 Extensibility 135, min
17 Resistance, EU
18 Max. resistance, EU
19 Proportion 17/16
20 Area (Energy), cm²
21 Loaf volume, ml/100 g flour

PERLO (BQG 8)			
Loaf volume, ml	644	Gluten swelling no., ml	20,0
Protein, %	14,7	Sedimentation, ml	69,6
Gluten, %	37,3	Falling number, sec	283
HMW Glutenin subunits:	2* 7+9 5+10		

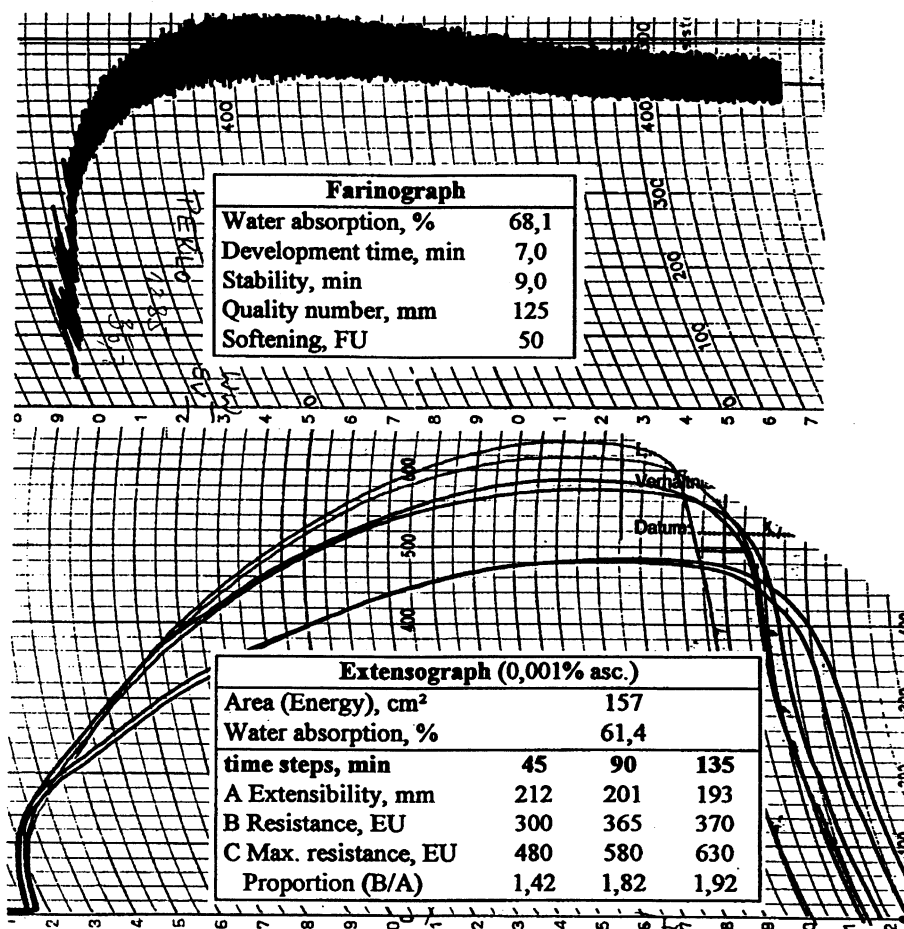


Fig. 2. Quality data of the cv. Perlo, a widely grown winter-wheat variety in the semiarid regions
 Slika 2. Podaci o kakvoći kultivara Perlo, koji se uzgaja na velikim površinama u semiaridnim regijama

DEFINITION OF "QUALITY WHEAT"

This term corresponds to varieties with a bread-making quality of groups 7, 8 and 9. More than 50 % of the seed multiplication fields are covered by these varieties (Fig. 4). On the average varieties of BQGs 7 to 9 have a protein content of at least 13,2%, a gluten content of 28% and a lower limit of 47 ml sedimentation-value and a water absorption of at least 61% (farinogram) and respectively 58% (extensogram). The Austrian term "quality

wheat" corresponds approximately with the German term "élite wheat" (5), whereas German quality wheats (group A) prevalingly belong to our category of good to intermediate breadmaking varieties (BQG 5 and6).

JUSTUS (BQG 4)			
Loaf volume, ml	512	Gluten swelling no., ml	19,0
Protein, %	13,8	Sedimentation, ml	38,6
Gluten, %	29,9	Falling number, sec	326
HMW Glutenin subunits:	N 6+8	2+12	

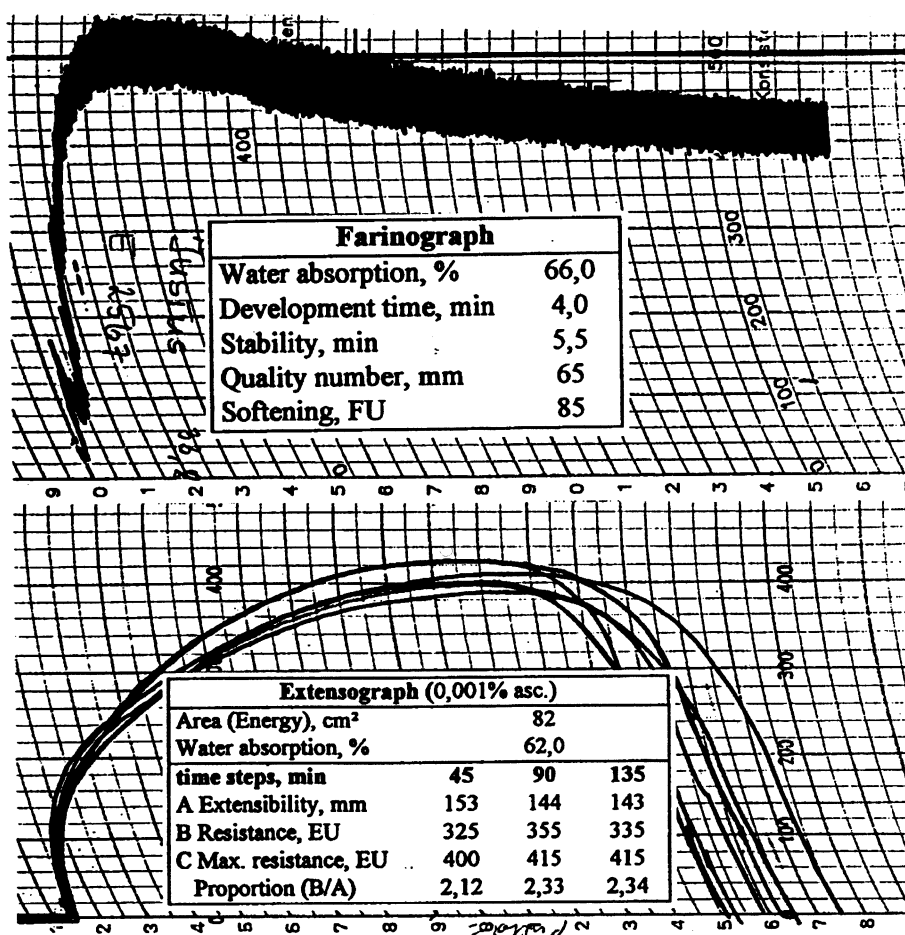


Fig. 3. Effect of different HMW glutenin subunits composition of cv. Justus (N, 6+8, 2+12) and cv. Claudius (1, 7+8, 2-12) on indirect quality characters and rheological properties of wheat dough.

Slika 3. Utjecaj različitih subjedinica glutenina velike molekularne težine kultivara Justus (N, 6+8, 2+12) i Claudius (1, 7+8, 2+12) na neizravna svojstva pekarske kakvoće i reološka svojstva tijesta.

CLAUDIUS (BQG 2)			
Loaf volume, ml	419	Gluten swelling no., ml	7,0
Protein, %	12,7	Sedimentation, ml	18,6
Gluten, %	33,0	Falling number, sec	308
HMW Glutenin subunits:	1 7+8 2+12		

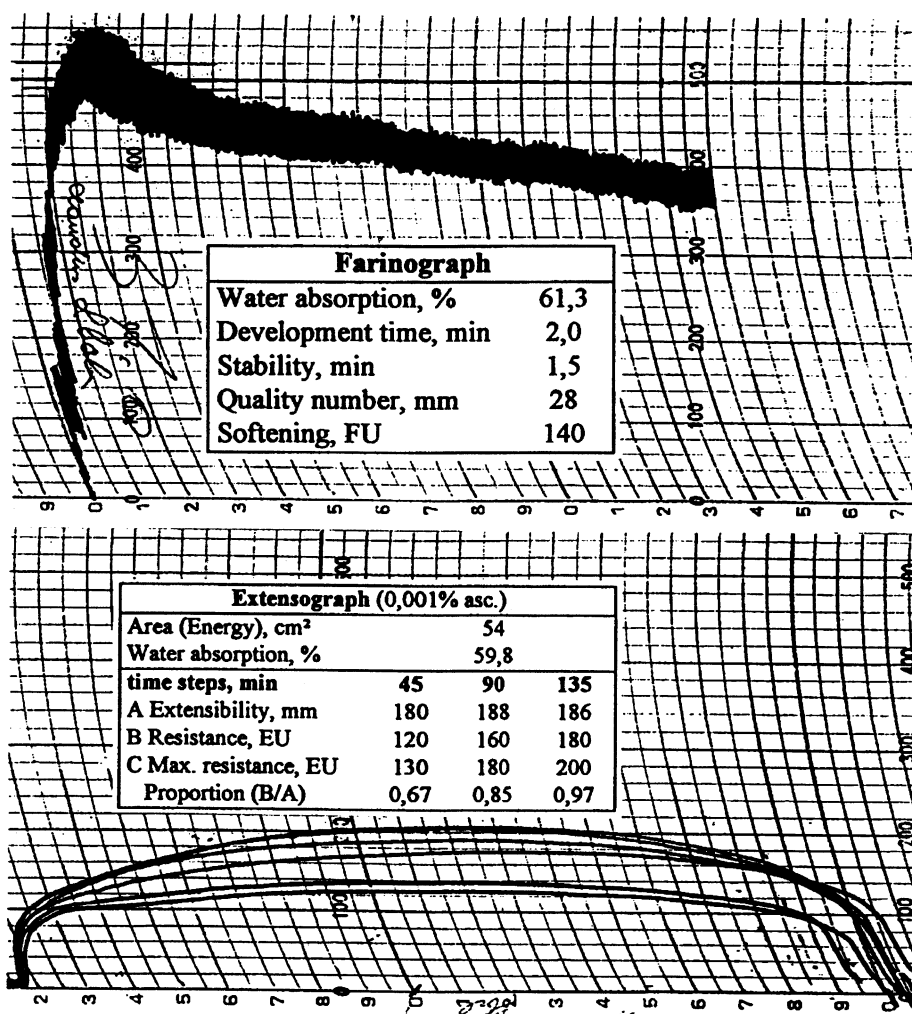


Fig. 3. (Continuation)
 Slika 3. (Nastavak)

Table 5. Intervarietal simple correlation coefficients between various characters of breadmaking quality of 62 winter-wheat genotypes tested in Austria (1978-1993) (51 cultivars, 11 breeding lines, calculation with adjusted means)
Tabela 5. Koefficienti korelacije između različitih svojstava pekarske kakvoće 61 genotipa ozime pšenice testirana u Austriji (1978-1993) (51 kultivar, 11 oplemenjivačkih linija, izračunato uz pomoć korigiranih srednjih vrijednosti)

Criterion	Wet gluten content	Gluten swelling number	Zeleny- Sedimen- tation	Water absorption	Developme nt time	Stability	Quality number	Softening	Extensi bility 135	Max. resist. 135	Area (Energy) 135	Loaf volume
<i>Indirect parameter:</i>												
Protein content (Nx5,7)	0,85**	0,60**	0,79**	0,62**	0,76**	0,70**	0,79**	-0,53**	0,57**	0,56**	0,67**	0,76**
Wet gluten content		0,25**	0,71**	0,70**	0,63**	0,49**	0,63**	-0,35**	0,63**	0,35**	0,51**	0,66**
Gluten swelling number			0,73**	0,32**	0,61**	0,78**	0,74**	-0,70**	0,38**	0,83**	0,84**	0,72**
Zeleny-sedimentation				0,77**	0,74**	0,76**	0,84**	-0,64**	0,65**	0,71**	0,83**	0,92**
<i>Farinogram-parameter:</i>												
Water absorption					0,63**	0,49**	0,66**	-0,37**	0,39**	0,32**	0,40**	0,71**
Development time						0,60**	0,80**	-0,30**	0,50**	0,52**	0,62**	0,79**
Stability							0,94**	-0,89**	0,38**	0,76**	0,79**	0,75**
Quality number								-0,76**	0,45**	0,70**	0,77**	0,85**
Softening									-0,29**	-0,71**	-0,71**	-0,61**
<i>Extensogram-parameter:</i>												
Extensibility 135										0,31**	0,62**	0,59**
Max. resistance 135											0,93**	0,72**
Area (Energy) 135												0,82**

Significance levels: * significant P = 0,05-0,01, ** highly significant P 0,01

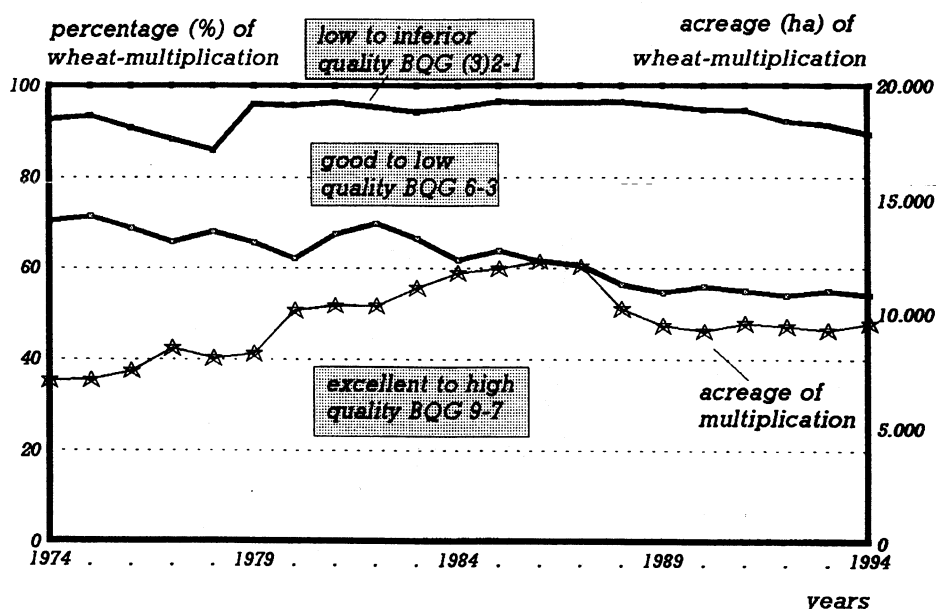


Fig. 4. Seed multiplication - Winter-wheat 1974-1994
 Slika 4. Sjemenska proizvodnja ozime pšenice 1974-1994

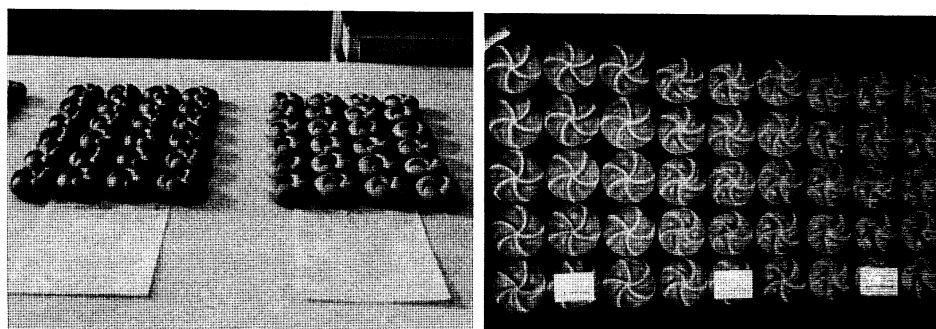


Fig. 5. The official testing of breadmaking quality of varieties: 1000 g flour are used to produce special rolls, called "Kaisersemmel".

Slika 5. Službeno testiranje pekarske kakvoće kultivar: 1000 g brašna se koristi za izradu posebnog peciva koje se naziva "Kaisersemmel" = carska žemčica

HMW-GLUTENIN SUBUNITS AND GLIADIN COMPOSITIONS

In the past years many authors have especially emphasized the importance of the alleles localized on the chromosomes 1A, 1B and 1D, also internal varieties and new breeding lines were investigated (6, 7, 8, 10). In the Austrian collection all three alleles (N, 1, 2*) are found for Glu-A1, mainly 6+8 as well as 7+9, rarely 7+8 and 7 for Glu-B1 and predominantly 2+12 and 5+10 (rarely 3+12) for Glu- D1. A few varieties have 1BL/1RS-

translocation and one variety a complete 1B/1R-substitution (8,9). The varieties with high bread-making quality (BQG 9, 8 and 7) mostly possessed the subunits 7+9 and 5+10; this is in good agreement with the results of German and Croatian cultivars (11, 12). Altogether 19 different allele compositions were found in Austrian cultivars and breeding lines (9), some varieties are mixtures of HMW subunits. Also remarkable differences in the presence of gliadin blocks from Lower Austria and Bavarian collections were shown (6). The knowledge of glutenine spectura is utilized by breeders when selecting crossing partners for transgressive recombinations.



Fig. 6. The different breadmaking quality of the varieties
Slika 6. Razlike u pekarskoj kakvoći kultivara

THE RELATIONSHIP OF INDIRECT QUALITY CHARACTERISTICS AND RHEOLOGICAL PROPERTIES WITH LOAF VOLUME

Significant differences with regard of protein content to the loaf volume were found between some varieties, the intervarietal association is high ($r=+0,76^{**}$). Gluten content is considered to be of greater importance in Austrian bakeries than in other countries. It is in close relation to the protein content of the grain, but differs significantly as to years and varieties (13). The Zeleny-sedimentation value shows the closest relation ($r=+9,92^{**}$) of all indirect parameters to the loaf volume. Farinogram parameters like development time ($r=+0,79^{**}$), stability ($r=+0,75^{**}$), quality number ($r=+0,85^{**}$) and softening ($r=-0,61^{**}$) and also the dough-area ($r=+0,82^{**}$) are always in a satisfactory intervarietal relation to the loaf volume. Besides of the dough properties a big loaf volume is the main criteria of the bread-making quality. Varieties with a big loaf volume are always well suited for manufacture (Tab. 5).

ECONOMICAL ASPECTS

In the past a price well above medium qualities was paid for high quality batches. The cultivation of quality wheat is frequently organized on contract base with compulsory seed purchase, an enormous incentive for breeders. At present, however extra compensations for quality wheat are less attractive. It can be assumed that the fraction of quality wheat will decrease to a level of about 45% of winter-wheat acreage in the next years, varieties of the BQGs 5 and 6 gaining increasingly importance.

Acknowledgment

The authors thank Prof. H. E. Oberlander for correction of the manuscript.

OPLEMENJIVANJE PŠENICE I PEKARSKA KAKVOĆA U AUSTRIJI

SAŽETAK

U Austriji se provodi učinkovito oplemenjivanje pšenice. Četiri poduzeća intenzivno rade na oplemenjivanju ozime pšenice, a različiti klimatski i edafski uvjeti postavljaju posebne zahtjeve u oplemenjivačkom radu. U svezi kultivara (uglavnom s osjem), koji su prikladni za semiaridnu Panonsku regiju učinjen je bitan napredak u prinosu, a pritom su se zadržali visoki standardi kakvoće. Za uzgoj u hladnijim i vlažnijim regijama u oplemenjivanju je posebna pažnja poklonjena kultivarima (većinom bez osja) s dobrom, srednjom ili nižom pekarskom kakvoćom. U suradnji s istraživačkim institucijama u oplemenjivačkom se radu sve više upotrebljavaju biotehnoške metode. Kultivari pšenice podijeljeni su u devet (1 do 9) grupa kakvoće (baking quality groups - BQGs) ovisno o pekarskoj kakvoći. U radu su pokazane jednostavne korelacije između parametara pekarske kakvoće. Većina austrijskih kultivara koji su visoke pekarske kakvoće (BQG 9, 8 i 7) posjeduju gluteninske subjednice velike molekularne težine GLU-B1 7+9 i Glu-D1 5+10. Kultivari sa srednjom i nižom pekarskom kakvoćom uglavnom imaju kombinacije 6+8 i 5+10 respektivno, 5+8 i 2 +12 respektivno i 7+8 i 2 +12.

REFERENCES - LITERATURA

1. Hansel, H., Siebert, L. Groger, S. and Lelley, T. 1994. Bericht über die Arbeitstagung der AG der Saatzuchtleiter. Gumpenstein, 15- 22.
2. Loschenberger, F. and Heberle-Bors, E. 1992. Die Bodenkulture 43, 115-12.
3. Lemmens, M., Burstmayer, H. and Ruckenbauer, P. 1993. Die Bodenkultur 44, 65-78.
4. Oberforster, M., Werteker, M. and Schmidt, L. 1994. Jahrbuch 1993 der Bundesanstalt für Pflanzenbau, 257-280.
5. Beschreibende Sortenliste 1995. Getreide, Mais Ölfruchte Leguminosen Hackfruchte.
6. Cerny, J., Sasek, A., Zimmermann, G. and Seibert, L. 1992. Scientia Agriculturae Bohemoslovaca 2, 113-123.
7. Cerny, J., Sasek, A., Ruckenbauer, P. and Oberforster, M. 1994. Unpublished manuscript.
8. Lelley, T. and Groger, S. 1993 Bericht über die Arbeitstagung der AG der Saatzuchtleiter, Gumpenstein, 13-19.
9. Groger, S., Bistrich, H. and Lelley, T. 1994. Proceedings: Wheat Kernel Proteins, Viterbo (Italy), 257-259).
10. Groger, S., Bistrich, H. 1995. personal communication.
11. Zeller, F. J. 1995. Getreide Mehl und Brot 49, 3-5.
12. Jošt, M., Fišter, Radojka, Skenderija, Maja and Mrazović, Božena 1995. Prehrambeno-biotechnol. rev. 33 (2-3), 103-109.
13. Hansel, H. and Ehrendorfer, K. 1973. Zeitschrift f. Pflanzenzüchtung 69, 169-209.

Adresa autora - Authors address:

dr. M. Oberforster
dr. M. Werteker
Bundesamt und Forschungszentrum für Landwirtschaft
Institut für Pflanzenbau
Spargelfeldstrasse 191, Postfach 400
A-1226 Wien
Austria

Primljeno-Received:

05.01.1996.