5. Kronberga A (2001) Tritikāles selekcijas izejmateriāla raksturojums un Latvijas agroekoloģiskajiem apstākļiem piemērota šķirnes modeļa izstrāde. Disertācijas kopsavilkums. Jelgava, 48.
6. Lammerts van Bueren E. T. (2002) Organic plant breeding and propagation: concepts and strategies PhD Thesis Wageningen University. The Netherlands. -196.
7. Lammerts van Bueren E.T., Wilbois K.P., Ostergard H. (2007) European perspectives of organic plant breeding and seed production in a genomics era In: Journal of Agriculture and Rural development in the Tropics and Subtropics, Supplement 89, 101.-120.
8. Legzdina L., Skrabule I. (2005) Plant breeding for organic farming: current status and problems in Europe. Report, Seminar ENVIRFOOD, http://orgprints.org/5703/01/EnvirfoodCompendiumOrgPlBreed.pdf , accessed on 05.02.2008.
9. Skrabule, I. (2005) Crop breeding for organic farming – current situation in Latvia. Proceedings of the seminar Environmental friendly food production system: requirements for plant breeding and seed production, Talsi, Latvia, 54-58.
10. Schneider D., Fossati D. and Mascher F. (2007) Breeding for varieties adapted to low-input conditions: Should we use old varieties? Østergård, H. and Fontaine, L., Eds. (2006) Cereal crop diversity: Implications for production and products. Proceedings of COST SUSVAR workshop, La Besse, Paris, 112-114.

IZLASES KRITĒRIJI TRITIKĀLES ŠĶIRŅU SELEKCIJĀ BIOLOĢISKAJAI LAUKSAIMNIECĪBAI

Kronberga A.

Priekuļu laukaugu selekcijas institūtā uzsākta bioloģiskajai lauksaimniecībai piemērotu šķirņu selekcija. Tās sākuma etapā tika veikta dažādu tritikāles genotipu izvērtēšana bioloģiskajā laukā ar mērķiem:
Novērtēt, vai iespējama bioloģiskajai lauksaimniecībai piemērotu genotipu izlase konvencionālās selekcijas laukā;
Atrast pazīmes, pēc kurām jāvērtē tritikāles genotipi, lai nodrošinātu to labu piemērotību bioloģiskajai lauksaimniecībai.
Izmēģinājums veikts trīs gadus (no 2005. līdz 2007.gadam). 25 dažādas tritikāles selekcijas līnijas atlasītas konvencionālās selekcijas laukā un izvērtētas bioloģiskajā laukā. Katram genotipam novērtētas 30 dažādas pazīmes, tai skaitā arī pazīmes, kas tiek uzskatītas kā nozīmīgas bioloģiskajai lauksaimniecībai (auga garums, cera forma u.c.). Novērtēta šo pazīmju korelācija ar ražu un kopproteīna saturu graudos. Katru gadu salīdzināti 25 genotipi bioloģiskajā un konvencionālajā laukā un novērtēta dažādu pazīmju variācija atkarībā no audzēšanas veida.
Iegūtie rezultāti liecina, ka dažādu genotipu reakcija uz bioloģiskajiem un konvencionālajiem audzēšanas apstākļiem atšķiras. Bioloģiskajai lauksaimniecībai piemērotu līniju atlasi iespējams veikt konvencionālās selekcijas laukā. Tomēr šīs līnijas pēc tam nepieciešams pārbaudīt bioloģiskajā laukā, lai novērtētu pazīmju stabilitāti un atlasītu bioloģiskajai lauksaimniecībai vispiemērotākās.
Pēc izmēģinājuma rezultātiem konstatēts, ka svarīgākie izlases kritēriji, veidojot bioloģiskajai lauksaimniecībai piemērotas ziemas tritikāles šķirnes ir to laba ziemcietība un izturība pret sniega pelējumu. Pētījumā netika pierādīts, ka bioloģiskajiem laukiem ir piemēroti genotipi tikai ar garu stiebru un klājenisku cera formu.

TESTING RESULTS OF THE SPRING BARLEY VARIETY 'RUBIOLA'

[1]Legzdiņa L., [1]Gaiķe M., [2]Gaile Z., [1]Bērziņa I.
[1]State Priekuli Plant Breeding Institute, Zinatnes str. 1a, Priekuli, Latvia, phone: +371-4130162, e-mail: lindaleg@navigator.lv
[2]RSF "Vecauce" of Latvia University of Agriculture, Akademijas str. 11a, Auce, Latvia

Abstract
One of problems for barley (*Hordeum vulgare* L.) in organic farming is its infection with seed born diseases, particularly with loose smut (*Ustilago nuda*). Currently in the Latvian Plant Variety

Catalogue there are no varieties completely resistant to this disease. Our aim was to offer a resistant variety acceptable for growing in organic conditions. The first step in breeding for organic farming was the evaluation of breeding lines from conventional breeding program under organic growing conditions. The breeding line PR-2797 ('Rubiola') was derived from a cross with a loose smut resistant parent. 'Rubiola' was tested under conventional growing conditions during 5 seasons in 1 site and under organic conditions during 3 seasons in 2 sites. The Latvian barley varieties 'Abava', 'Idumeja', 'Ansis' and 'Ruja' were used for comparison. The yield of 'Rubiola' under conventional growing conditions was superior to extensive type varieties, but it could not surpass the intensive check 'Ansis'. The mean yield of 'Rubiola' under organic conditions did not significantly differ from the check varieties. The results indicate that a significant yield gain for 'Rubiola' under organic growing conditions could be achieved by increasing the seed rate. Resistance to the loose smut of 'Rubiola' was improved by artificial inoculation and by PCR-based markers. The most important advantage of 'Rubiola' for organic farming was its resistance to loose smut; notable was also its relatively low infection with leaf diseases, high spike productivity and grain volume weight. 'Rubiola' was entered for VCU (Value for Cultivation and Use) and DUS (Distinctness, Uniformity and Stability) testing starting from 2007.

Key words: barley breeding, organic farming, agronomic traits, loose smut resistance, seed rate

Introduction

Two types of breeding programs dealing with organic farming exist: conventional breeding for organic agriculture with the testing of advanced lines in organic conditions in the later stages and organic breeding programs where all steps are performed under organic conditions using breeding techniques in conformity with organic principles (Lammerts van Bueren *et al.*, 2007). For example in Austria the breeding of winter wheat for organic agriculture is carried out combing to conventional (until F_5 generation) and organic growing conditions (Loshenberger, 2007). Barley (*Hordeum vulgare* L.) breeding for organic farming is a developing direction in the Priekuli Plant Breeding Institute. The first steps were the evaluation of the registered varieties (Legzdina *et al.*, 2005) and breeding lines from conventional breeding programs under organic growing conditions and the investigation of the most efficient selection criteria and methods differing from conventional breeding.

The main requirements for cereal varieties adapted to organic farming are related to improved nutrient uptake and use efficiency due to limited nutrient availability in soil, competitive ability with weeds and resistance to diseases (Lammerts van Bueren, 2002). One of problems for barley in organic farming is infection with seed born diseases, particularly loose smut (*Ustilago nuda* (Jens.) Rostr.). The regulations for seed production in organic farming are the same as in conventional farming, but chemical seed treatment is not allowed. According to the research results of acceptable seed treatment methods in organic farming, only treatment with hot water can reduce infection with loose smut to the acceptable level, but it is not economic and it is difficult for farmers to organize such treatment. The choice of resistant varieties is an important component of preventative strategy. Loose smut of barley can be mainly controlled by choosing resistant varieties. (Borgen, 2004) Currently there are no varieties included in the Latvian Plant Variety Catalogue that are resistant to loose smut; only the variety 'Rasa' is recommended for organic farming (Latvian Catalogue of Plant Varieties, 2007). The aim of this study is to summarize the testing results of the new barley variety 'Rubiola'.

Materials and Methods

The spring barley breeding line PR-2797 ('Rubiola') was derived from the cross combination of Ruja/Run 458. 'Ruja' is a medium late maturing Latvian variety and Run 458 is a Canadian line with the loose smut resistance gene Un8. At first the line was tested in regular breeding nurseries under conventional conditions (until 2003) and discarded. Due to resistance to loose smut the line was selected for testing under organic conditions (2004-2006). Additional testing under conventional conditions was performed during the preparation of the line for registration (2006-2007).

Trial 1 summarizes the testing results of the breeding line PR-2797 under conventional growing conditions in breeding nurseries in Priekuli during 2001-2003 and 2006-2007 in 6 replications and 23.1 m^2 plots. The variety 'Abava' was used as a check during 2001-2003, but 'Ansis' and 'Idumeja' were checks during 2006-2007. Soil characteristics: sod-podzolic (2001-2003, 2006) and sod-podzolic gley (2007) soil, loamy sand and sandy loam, organic matter 11-27 g kg^{-1}, pH_{KCl} 5.2-5.5 (2003, 2007) and 5.8-6.1 (2001, 2002, 2006), P 58-119 mg kg^{-1}, K 105-163 mg kg^{-1}. Fertilizer N 81-86, P 40.5-43, K 43-67.5 kg ha^{-1} and herbicides Granstar and Primus and the insecticide Fastac were applied. The seed rate was 400 seeds able to germinate per m^2; the seed was not treated.

Trial 2 was arranged in Priekuli and Vecauce in fields certified for organic farming in 4 replications during 2004-2006. Plot size in Priekuli was 12.3 m^2 and in Vecauce 25 m^2. The varieties 'Abava', 'Idumeja' and 'Ruja' (Latvia) were used for comparison. Soil characteristics in Priekuli: sod-podzolic soil, loamy sand and sandy loam, organic matter 21-23 g kg^{-1}, pH_{KCl} 5.4-6.3, P 69-124 mg kg^{-1}, K 100-191 mg kg^{-1}. Soil characteristics in Vecauce: sod-gleysolic soil, sandy loam, organic matter 19-32 g kg^{-1}, pH_{KCl} 6.8-7.5, P 21-40 mg kg^{-1}, K 50-71 mg kg^{-1}. The seed rate 400 seeds able to germinate per m^2 was applied. Harrowing was used in the tillering stage. Protein and starch were determined by a Infratec grain analyzer (Foss) and expressed in % in dry matter. Sprouting was evaluated in Vecauce in 2005 by calculating % of the sprouted kernels in 75 spikes from two replications. Traits related to weed suppression ability were determined in Priekuli during 2006-2007. Emergence was calculated in % after counting emerged plants in 2 x 0.1 m^2 per plot. Soil shading was estimated visually in % at the end of the tillering stage. Plant height in the shooting stage was measured once per plot. The length and width of flag leaf was measured for 10 plants per plot after flowering.

Trial 3 was performed under organic growing conditions in Priekuli during 2005-2006 (growing conditions as in trial 1) in 4 replications with plot size 23.1 m^2. Three seed rates (250, 400 and 550 seeds able to germinate per m^2) were compared for the varieties 'Rubiola', 'Ruja' and 'Idumeja'.

Infection with powdery mildew (*Blumeria graminis* f.sp. *hordei*) and netblotch (*Drechslera teres* (Sacc.) Shoem) was scored in Priekuli according to a 0-4 scale (0-no infection, 4-strong infection) and in Vecauce disease severity in % was assessed. Lodging was scored according to a 1-9 scale (1-compleately lodged, 9-no lodging).

The particularities of the meteorological conditions: in 2001 higher air temperature and an amount of rainfall larger than the long-term average was observed in July when severe lodging was caused by heavy thunderstorms 2002 was overall warm and dry (air temperature higher by 2.6 ºC and the amount of rainfall 36% lower than the long-term data). The beginning of the growing season in 2003 was wet, very dry conditions were observed in the beginning of June, middle of July and the beginning of August. A high amount of precipitation in August (270% of the long-term average) caused lodging and sprouting. In 2004 dry conditions in April and May hindered plant emergence, a high amount of rainfall was registered at the end of June (245 and 232% of the long-term data in Priekuli and Vecauce) and in the middle of August and the mean air temperature in May, June and July was below the long-term data. In 2005 enduring and heavy rainfalls were registered in the middle of May and the extremely high amount of rainfall was recorded in the beginning of August (398% of the long term data in Priekuli and 142% in Vecauce) caused sprouting. 2006 was very dry (47% rainfall of the long term data in the growing season) and the mean temperature in the growing season was 2 °C above the long term average.

'Rubiola' was tested by artificial inoculation with loose smut during 2004-2006; its parent variety 'Ruja' which is susceptible to loose smut was used for comparison. Each flower in 3 spikes per genotype was infected during anthesis with a syringe containing a local loose smut population spore suspension of 1 g l^{-1}. The infected seeds were harvested and sown next season; the presence of plants with loose smut symptoms was stated.

DNA was extracted from 1 week old seedlings of the varieties 'Rubiola', 'Ruja' and 'Run 458' using the Genomic DNA Purification Kit (Fermentas). PCR (polymerase chain reaction) amplification using SCAR (sequence characterized amplified region) primers for detection of resistance and susceptibility to loose smut was carried out according to the protocol of Eckstein *et al.* (2002). The forward primer T800F4 was used for both resistant and susceptible allele. The

primer T800R was used to prime the resistant allele and to amplify a single 716 bp band. The primer H700R was used to prime the susceptible allele and to amplify a single 714 bp band.
Two and three way ANOVA was applied for statistical data analysis.

Results and Discussion

The testing results of 'Rubiola' under conventional growing conditions (trial 1) are summarized in Table 1. The yield of the line was significantly higher than that of the check variety 'Abava' in 2001 and 2003; it did not significantly differ from the checks 'Ansis' and 'Idumeja' in 2006, but the differences were significant in 2007 (p=0.05, Figure 1).

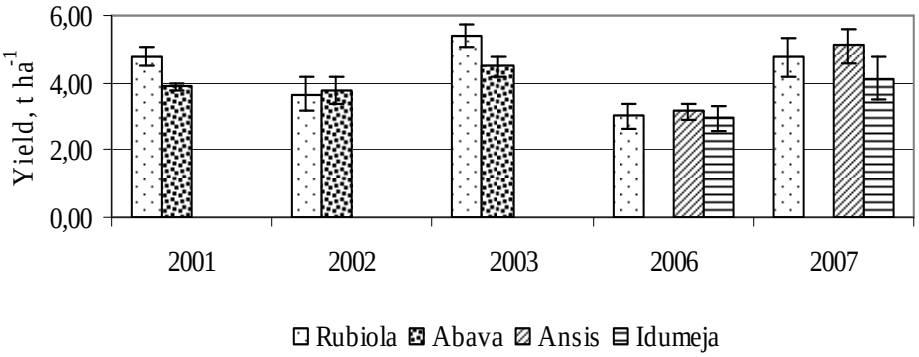


Figure 1. Yield of 'Rubiola' and check varieties under conventional growing conditions.

The length of vegetation of 'Rubiola' was similar to the medium–late varieties 'Abava' and 'Ansis'. Slightly better resistance to lodging was observed for 'Rubiola' if compared to 'Abava' in the years when lodging problems accrued. 'Rubiola' provided the highest volume weight of all the compared varieties.

Table 1. Testing results under conventional growing conditions (Priekuli)

Variety	Grain yield, t ha^{-1}	Vegeta-tion, days	Lodging, 1-9 [1]	TKW, g	Volume weight, g l^{-1}	Powdery mildew, 0-4 [2]	Net-blotch, 0-4 [2]	Loose smut, spikes per m^2	Number of kernels per spike	Kernel weight per spike, g
2001-2003										
Rubiola	4.62	96	7.7	45.2	684	1.3	0.9	0.1	22.7	1.07
Abava	4.05	96	6.5	44.1	659	2.6	2.2	0.9	19.9	1.03
LSD $_{0.05}$	0.23									
2006-2007										
Rubiola	3.90	99	9	45.8	706	0.8	0.8	0	21.4	1.00
Ansis	4.13	100	9	44.6	701	0.3	0.5	0.8	19.0	0.90
Idumeja	3.55	93	9	48.2	660	1.7	2.2	2.5	17.8	0.85
LSD $_{0.05}$	0.40									

[1] 9-no lodging; 1-compleately lodged; [2] 0-no infection, 4-very high infection

The infection level of 'Rubiola' with powdery mildew and netblotch was lower than 'Abava' and 'Idumeja'. Only 'Ansis' had less infection. Practically no loose smut infection was found in 'Rubiola'; only a few infected plants were found more likely to admixtures. Superior spike productivity was ascertained for 'Rubiola' in comparison to all other checks.
The mean grain yield of 'Rubiola' during its three years under organic growing conditions in the two locations (trial 2, Table 2) did not significantly differ from the check varieties. The yield of 'Rubiola' surpassed significantly that of 'Abava' (Vecauce, 2004; p=0.05, Figure 2), 'Ruja' (Priekuli, 2005) and 'Idumeja' (Priekuli and Vecauce 2005), but it was significantly lower than the

yield of 'Abava' and 'Idumeja' in Vecauce in 2006. Extremely dry conditions in 2006 had a particularly negative influence on the yield of 'Rubiola' and its parent variety 'Ruja'.

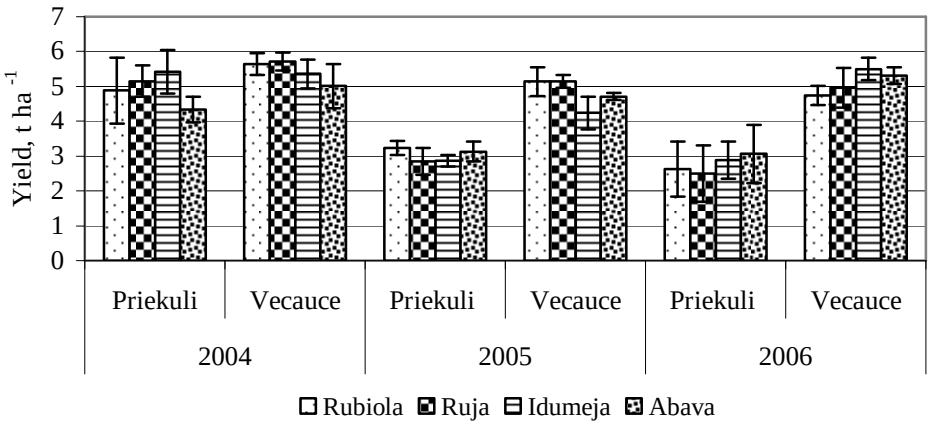


Figure 2. Grain yield under organic growing conditions

The vegetation period of 'Rubiola' was one day shorter than that of the parent variety 'Ruja', equal to 'Abava' and 8 days longer than for the early maturing variety 'Idumeja'. The medium–tall plants of 'Rubiola' can be considered as an advantage for organic growing conditions because of their weed suppressing ability. Superior volume weight was stated for 'Rubiola' similarly to conventional growing conditions (significant advantage over 'Idumeja' and 'Ruja'). No significant differences in grain chemical composition between the varieties was found.

Table 2. Yield, length of vegetation, plant height and grain quality under organic growing conditions (average from Priekuli and Vecauce, 2004-2006)

Variety	Grain yield, t ha^{-1}	Vegetation, days	Plant height, cm	TGM, g	Volume weight, g l^{-1}	Protein, g kg^{-1}	Starch, g kg^{-1}
Rubiola	4.38	101	82	46.3	688	126	602
Ruja	4.39	102	78	48.2	668	123	604
Abava	4.26	101	85	45.7	685	126	602
Idumeja	4.38	93	72	47.1	646	126	605
$LSD_{0.05}$	0.28	1.6	4.3	2.4	19.4	n.s.	n.s.
p genotype	0.4	<0.001	<0.001	0.2	<0.001	0.3	0.7
p environment	<0.001	<0.001	<0.001	<0.001	0.3	<0.001	<0.001

Although the differences were not significant, infection with powdery mildew was lowest for 'Rubiola' if compared to the check varieties (Table 3). The infection level with netblotch was the lowest for 'Rubiola' also; showing significant superiority over 'Abava' and 'Idumeja' in the Priekuli tests. Significantly lower in infection with loose smut was 'Rubiola' (few infected plants are more likely due to admixtures) in comparison to 'Abava' and its parent variety 'Ruja' as stated in Priekuli. In Vecauce the infection level with loose smut was very low and no infected plants were found for 'Rubiola'. The lowest sprouting rate among the tested varieties was found for 'Rubiola'; more than half of the kernels were sprouted for the early maturing variety 'Idumeja'.

Table 3. Infection with diseases and sprouting in organic growing conditions (average from Priekuli and Vecauce, 2004-2006)

Variety	Powdery mildew, Priekuli, 0-4	Powdery mildew, Vecauce, %	Netblotch, Priekuli, 0-4	Netblotch, Vecauce, %	Loose smut[1], spikes per m^2	Sprouting[2], %
Rubiola	1.25	6.04	1.42	0.92	0.08	5.5
Ruja	2.50	9.75	1.92	3.11	4.62	5.9
Abava	2.75	11.92	2.75	6.37	5.75	9.7
Idumeja	1.75	10.97	2.67	1.46	0.11	54.3

$LSD_{0.05}$	n.s.	n.s.	1.21	n.s.	4.5	7.1
p genotype	0.2	0.4	0.1	0.1	0.04	<0.001
p year	0.01	0.007	0.3	0.05	0.2	-

[1] in Priekuli; [2] 2005 in Vecauce

The expression of traits related to the weed suppression ability of 'Rubiola' are close to the average values of all tested varieties and breeding lines in most of the cases (Table 4). This can be explained by the fact that 'Rubiola' was not selected under organic growing conditions and no special attention was paid to such traits. The soil shading of 'Rubiola' was only a little better than the average; plant height in shooting was equal to the average value or a little higher. Genotypes with significantly longer and wider flag leaves than 'Rubiola' were found among the tested breeding lines.

Table 4. Weed suppression ability determinative traits (Priekuli, 2006-2007)

Genotypes		Soil shading in tillering, %		Plant height in shooting, cm		Length of flag leaf, cm		Width of flag leaf, mm	
		2006	2007	2006	2007	2006	2007	2006	2007
Rubiola		65	73	36	33	11.7	11.1	8.6	8.1
Varieties and breeding lines[1]	average	61	70	36	30	12.3	11.4	8.5	8.0
	min-max	45-71	55-79	30-47	25-38	9.3-14.5	8.6-13.7	6.5-10.2	5.4-10.5
$LSD_{0.05}$		n.s.	9.3	4.4	4.3	1.75	1.20	1.20	0.71

[1] n=21 in 2006 and n=18 in 2007

The results of Trial 3 indicate that a significant yield gain can be achieved for 'Rubiola' by increasing the seed rate from 250 to 400 and from 400 to 550 seeds able to germinate per m^2 (Table 5). Similar results were obtained for 'Ruja', but for 'Idumeja' a seed rate of 400 provided the highest yield and the further increase of seed rate was not effective. The reason for this is not clearly recognizable yet.

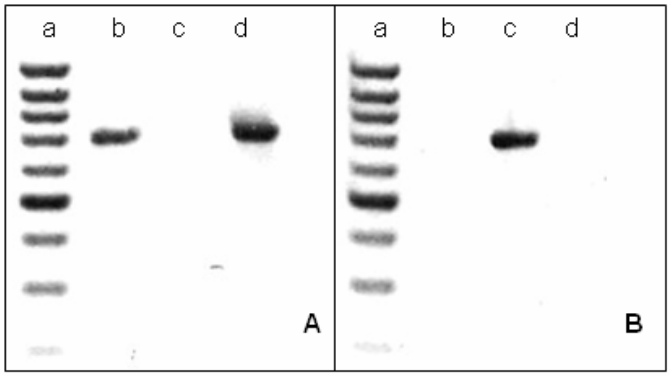
Table 5. Effect of seed rate increase under organic growing conditions (Priekuli, 2005-2006)

Variety	Yield, t ha^{-1}			TGW, g			Volume weight, g l^{-1}			Infection with netblotch, 0-4 [2]		
	250[1]	400[1]	550[1]	250	400	550	250	400	550	250	400	550
Rubiola	2.29	2.92a	3.36ab	51.1	49.0a	48.0a	682.8	683.1	690.0a	0.81	0.95	1.13
Ruja	1.93	2.33a	2.83ab	52.6	49.9a	49.7a	661.4	662.6	668.6a	1.35	1.75	2.01a
Idumeja	2.37	3.17a	3.21a	50.6	49.4	48.8a	650.4	651.6	655.5	2.19	2.50	2.75a
year		17.5			11.5			12.7			32.7	
genotype		12.3			9.5			60.2			37.7	
seed rate		29.6			39.4			2.7			4.3	

[1] seed rate; a- significant difference from seed rate 250, b-significant difference from seed rate 400 (p=0.05)
[2] 0-no infection, 4-very high infection

Gruber *et al.* (2003) reported that higher seed rate (200-450 seeds able to germinate per m^2 tested for spring barley) resulted in higher yield for cereals, but it is not always economical. The possible explanation could be the not very high productive tillering coefficient of 'Rubiola' (during 2006-2007 under conventional conditions it was 2.7 and 3.5 for 'Rubiola' and 'Idumeja' respectively). On the other hand, the number of productive tillers per m^2 for 'Rubiola' was higher than that of 'Idumeja' under organic growing conditions (418 and 366, respectively, average from 2006-2007). The difference between early maturing 'Idumeja' and medium-late maturing 'Ruja' and 'Rubiola' can be possible explained by the longer lasting influence of the higher weed biomass in the case of lower seed rates for late maturing varieties. The decrease of TGW and the increase of volume weight was observed along with the increase of seed rate for all varieties. A slight increase of infection with netblotch was found with increased seed rate (the difference is not significant for 'Rubiola'). The results show that the increase of seed rate had a more positive influence on yield

gain than the yield reduction caused by netblotch infection. The influence of seed rate on TGW and grain yield was high, but it was less on volume weight and infection with net blotch.
The results of artificial inoculation improve the resistance of 'Rubiola' against loose smut; 0% infected plants were found during 3 cycles of testing and we presume that the line has the *Un8* resistance gene. For the susceptible parent variety 'Ruja' most of the infected plants (80-90%) had loose smut symptoms. Primers T800F4 and T800R amplified a single band in varieties the 'Rubiola' and 'Run 458' (Fig. 3A). Primers T800F4 and H700R amplified a single band in the variety 'Ruja' (Fig. 3B). These results indicate that the variety 'Rubiola' carries the resistance gene *Un8* which is obtained from the parent 'Run 458'.



(a) 100 bp GeneRuler^{TM} DNA ladder (Fermentas); (b) 'Rubiola'; (c) 'Ruja'; (d) 'Run 458'.

Figure 3. Amplification of the genomic DNA of the barley varieties 'Rubiola', 'Ruja' 'Run 458' using primers specific for (A) the resistant allele of (B) the susceptible allele.

Conclusions

The grain yield of 'Rubiola' in conventional growing conditions was able to surpass the extensive type varieties ('Abava' and 'Idumeja'), but it could not surpass the intensive type variety ('Ansis').
The most important advantage of 'Rubiola' for organic farming is its resistance to loose smut; notable are also its relatively low infection with leaf diseases, optimal plant height, spike productivity and grain volume weight. 'Rubiola' was not the most optimal genotype regarding a number of traits desirable for organic growing conditions like the length of vegetation and traits determining weed suppression ability.
The increasing of seed rate might be beneficial for obtaining a higher yield for the variety 'Rubiola' under organic growing conditions.
'Rubiola' was entered for VCU (including organic testing) and DUS testing from 2007. If the testing results will be successful, the variety will be recommended for growing in organic farms.

Acknowledgement
We are thankful for professional assessment of infection with leaf diseases in location Vecauce to assoc. prof. Dr. Biruta Bankina.

References

1. Borgen A. (2004) Strategies for regulation of seed borne diseases in organic farming. *Seed Testing International*, 127, 19-21.
2. Eckstein P. E., Krasichynska N., Voth D., Duncan S., Fossnagel B. G., Scoles G. J. (2002) Development of PCR-based markers for a gene (Un8) conferring true loose smut resistance in barley. *Canadian Journal of Plant Pathology*, 24, 46-53.
3. Gruber H., Thamm U., Michel V. (2003) Einfluss der Saatstärke auf Ertragsmerkmale bei Getreide http://orgprints.org/1150/, assessed on 30.01.2008.
4. Lammerts van Bueren E.T. (2002) Organic plant breeding and propagation: concepts and strategies. PhD Thesis, Wageningen University, The Netherlands. 196.
5. Lammerts van Bueren E.T., Baresel J.P., Desclaux D., Goldringer I., Hoad S., Kovacs G., Löschenberger F., Miedaner T., Østergård H., Wolfe M. (2007) Developments in breeding cereals for organic farming systems in Europe. In: Lammerts van Bueren, Goldringer, Sholten, Ostergard (Eds) *Plant breeding for*

organic and sustainable, low-input agriculture: dealing with genotype environment interactions. Book of abstracts of the Eucarpia Symposium of Working Group Organic Plant Breeding, Wageningen, The Netherlands, 4.
6. Latvian Catalogue of Plant Varieties (2007) http://www.vaad.gov.lv/default.aspx?tabID=6&lang=1 , assessed on 3.01.2008.
7. Legzdina L., Bleidere M., Praulina O., Gaile Z., Vigovskis J., Švarta A. (2005) Performance of Latvian spring barley (*Hordeum vulgare* L.) varieties in conditions of organic farming. *Agronomijas vēstis*, 8, 340-344. (in Latvian)
8. Loshenberger F. (2007) Breeding for organic agriculture – strategy and example in practice. In: Lammerts van Bueren, Goldringer, Sholten, Ostergard (Eds) *Plant breeding for organic and sustainable, low-input agriculture: dealing with genotype environment interactions.* Book of abstracts of the Eucarpia Symposium of Working Group Organic Plant Breeding, Wageningen, The Netherlands, 47.

VASARAS MIEZU SKIRNES 'RUBIOLA' PARBAUDES REZULTATI

Legzdiņa L., Gaiķe M., Gaile Z., Bērziņa I.

Viena no miežu (*Hordeum vulgare* L.) audzēšanas problēmām bioloģiskajā lauksaimniecībā ir inficēšanās ar slimībām, kuru ierosinātāji saglabājas sēklas materiālā, īpaši ar putošo melnplauku (*Ustilago nuda*). Pašlaik neviena no Latvijas Augu šķirņu katalogā iekļautajām šķirnēm nav izturīga pret šo slimību. Mūsu mērķis bija piedāvāt audzētājiem izturīgu šķirni, kas būtu piemērota bioloģiskajiem audzēšanas apstākļiem. Pirmais solis, uzsākot selekciju bioloģiskās lauksaimniecības vajadzībām, bija konvencionālajā selekcijas programmā izveidotu selekcijas līniju pārbaude bioloģiskos apstākļos. Selekcijas līnija PR-2797 ('Rubiola') izveidota no krustojuma kombinācijas, kurā viens no vecākaugiem ir ar izturības gēnu Un8 pret putošo melnplauku. Rakstā apkopoti rezultāti par 'Rubiolas' pārbaudes rezultātiem konvencionālos apstākļos (5 gadi) un bioloģiskos apstākļos (3 gadi). Salīdzināšanai izmantotas Latvijā selekcionētas miežu šķirnes 'Abava', 'Idumeja', 'Ansis' un 'Rūja'. Konvencionālos apstākļos 'Rubiolas' raža pārspēja ekstensīva tipa šķirnes, taču tā atpalika no intensīvā tipa šķirnes 'Ansis'. 'Rubiolas' vidējā raža bioloģiskos apstākļos būtiski neatšķīrās no standartšķirņu ražas. Rezultāti rāda, ka būtisks ražas pieaugums šķirnei 'Rubiola' bioloģiskos audzēšanas apstākļos var tikt sasniegts, palielinot izsējas normu. Šķirnes izturība pret putošo melnplauku pierādīta, veicot mākslīgo inficēšanu un izmantojot molekulāros marķierus. Nozīmīgākā šķirnes 'Rubiola' priekšrocība bioloģiskajā lauksaimniecībā ir tās izturība pret putošo melnplauku; vērā ņemama ir arī relatīvi nelielā inficēšanās ar lapu slimībām, vārpu produktivitāte un augstā graudu tilpummasa. Šķirnei 'Rubiola' SĪN (saimniecisko īpašību noteikšanas) un AVS (atšķirīguma, viendabīguma un stabilitātes) pārbaudes uzsāktas no 2007.gada.

EVALUATION OF SPRING BARLEY MALTING VARIETIES FOR BREEDING PROGRAMMES

Leistrumaitė A., Paplauskienė V., Mašauskienė A., Statkevičiūtė G.
Lithuanian Institute of Agriculture, Instituto al. 1, Akademija, Kėdainiai district, Lithuania, LT-58344, phone +370 347 37398, e-mail: alge@lzi.lt

Abstract

During the period 2005-2007 grain yield stability and the malt quality characteristics of malting spring barley varieties were investigated at the Lithuanian Institute of Agriculture. The growing conditions in 2005 and 2006 were dry and in 2007 were rather wet compared with the long-term mean. The high temperatures and drought in June of 2006 impacted low grain >2.5 mm yield and high protein content. The relationships between the lengths of spring barley growth periods and quality traits were evaluated. Using the software STABLE the stability of malting barley grain, course grain and extract yields as affected by the weather conditions during the crop year, genotype properties for varieties, as well as the interactions of variety and weather conditions were estimated. The selection of varieties promising in terms of grain yield, >2.5 mm grain yield and extract yield, was based on their ability to realize their genetic potential in various meteorological