

**XVIII INTERNATIONAL  
ECO-CONFERENCE® 2014  
24<sup>th</sup> - 27<sup>th</sup> SEPTEMBER**

# **SAFE FOOD**



**PROCEEDINGS**

**NOVI SAD, SERBIA**

*Publisher*

ECOLOGICAL MOVEMENT OF NOVI SAD

21000 Novi Sad, Vojvodanskih brigada 17/I

Phone/Fax: (+381 21) 529-096

Phone: (+381 21) 420-175

E-mail: [ekopokretns@gmail.com](mailto:ekopokretns@gmail.com)

[www.ekopokret.org.rs](http://www.ekopokret.org.rs)

*Editorial Board*

Academician Rudolf Kastori, President

Nikola Aleksić,

Prof. Ana Perenić

Prof. dr Desanka Božidarević

Prof. dr Rodoljub Oljača

Prof. dr Olga Najdenovska

Prof. dr Imre Kadar

*Project Editor*

Nikola Aleksić

*Copy Editor*

Ana Perenić

*Layout and Formatting*

Ljubica Aleksić

*For the Publisher*

Nikola Aleksić, Direktor

*Print*

„ALBUM” DOO Novi Sad

*Circulation*

500 copies

Publication year: 2014

THE AUTHORS ARE RESPONSIBLE FOR THE  
QUALITY OF ENGLISH TRANSLATIONS



ECO-CONFERENCE® 2014

ECOLOGICAL MOVEMENT OF NOVI SAD

Kamenko Bratković<sup>1</sup>, Milivoje Milovanović<sup>1</sup>, Vladimir Perišić<sup>1</sup>,  
Vera Đekić<sup>1</sup>, Kristina Luković<sup>1</sup>

<sup>1</sup>Center for Small Grains, Kragujevac, 34000 Kragujevac, Serbia  
*kamenko@kg.ac.rs*

## NEW CULTIVAR WINTER TWO-ROW BARLEY KG ZLATNIK

### Abstract

The new cultivar Kg Zlatnik breedings at the Center for Small Grains in Kragujevac and was approved by the Varietal Commission in 2012. In two-year studies had an average yield of 8,183 kg / ha which is significantly more than the standard cultivar Novosadski 525. It is characterized by strong, elastic stem. On average was stem shorter by 2.9 cm and more resistant to lodging than the standard cultivar. Has significant resistance to diseases and pests and its recommended for use in organic production. The middle early cultivar and benefiting from the intensive production conditions. Kg Zlatnik has a large and uniform grain, high hectolitar mass and low protein content as to the characteristics of malt can be considered beer cultivar and quality of raw materials for malt.

**Keywords:** *two-row malting barley, cultivar, yield, quality*

### INTRODUCTION

Barley (*Hordeum vulgare L.*) is one of 40 species of the genus *Hordeum* in the grass family *Poaceae*. It belongs to the group of small grains and inbred plants. The beginnings of growing barley are more than 7,000 years and as such belongs to the oldest crop plants. Nowadays, 55-60% barleys used for livestock feed, 30-40% of the production of malt, 5% for seed production, and only 2-3% of the human diet (Ullrich, 2011). Barley has the widest geographical distribution as compared to all other types of cereals. The world is grown on an area of about 57 million hectares with an average yield achieved from 2.4 t / ha and this parameter is the fifth grown crop (after maize,

rice, wheat and soybean). In our country, the barley is grown on about 90,000 ha with an average yield of about 3 t/ha (FAO 2012). In relation to the six-year period (1995-2000) when the surface was 126,500 ha was observed continuously reducing areas where barley is grown (Pržulj and Momčilović, 2010). In our area there are winter and spring barley cultivars. Winter are frequent in the plains and hills while spring cultivars have greater significance in the hilly and mountainous areas (Maksimović and Krstić, 1990).

Breeding plants can be said to have intended to plant genetic change so that they better meet the needs of the man (Becker, 1993). Create a new malting barley to be stable is a long process because of the quality of grain and malt influence genetic factors and environmental factors and their interaction. That's why testing is required to determine the purpose for the cultivar in some years may act as a brewery and as animal. In addition to high yield and good quality cultivars must be tolerant to diseases and pests, in order to reduce as much as possible the use of plant protection chemicals, in order to obtain and cheaper manufacture products as safer for human health and environmental protection (Pržulj i Momčilović, 2008). The aim of the barley breeding program at the Center for Small Grains in Kragujevac based on creating cultivars that will be characterized by high yield, quality and stability in most cultivated areas for many years (Djekić et al., 2014).

The aim of this paper is to present the agronomic and technological characteristics of the new cultivar Kg Zlatnik.

## MATERIALS AND METHODS

Cultivar Kg Zlatnik was created by crossing the line KG-13/4-92 and SSK-89/90/16. The hybrid material was grown by the pedigree method (unselected plants in the F1-F4 generation). For older generations have chosen those uniform progeny of which is a separate line KG-31/61/01. This line has been reported Variety Commission in 2008 after two years of tests recognized in 2012. called Kg Zlatnik.

According to the botanical origin variety belongs winter two-row barley - *Hordeum vulgare ssp. distichum var. nutans*. Morphologically characterized by flexible green stems, the leaves are ligulate with light green color, ear is bent with two-row and long, yellow awns and kernells are big, yellow with glumes..

The study was conducted under the code at seven locations in the period 2008-2010. year. In Novi Sad, Pancevo, Sremska Mitrovica, Sombor and Zajecar experiments have been conducted in both years while in Kragujevac only in the first year (2008/2009) resp. Kikinda only in the second year (2009/2010). The experiments were designed randomized block design, with the basic plot size of 5m<sup>2</sup> with four replications. As a standard cultivar for comparison served winter two-row malting barley Novosadski 525. During the field trials was conducted evaluation earliness and height. Plant height is the height from the base of the stem to the top of the ear. The intensity of disease is shown as a percentage of infection by a modified Cobb's scale (0-99) in Kragujevac 2008/2009. Line resistance to low temperature in the cold chamber

was carried out on the samples examined in Novi Sad in 2009/2010. and the data is in the form of plant survival. In evaluating resistance to lodging uses the scale of 0-9 (0-resistant, 9- frail).

Samples for laboratory tests were taken from the location Novi Sad in the first year. Analysis of physico-mechanical and chemical-technological properties was carried out at the Institute for Food Technology in Novi Sad standard methods.

The values shown for earliness, plant height, resistance to lodging and grain yield represents the mean of the locations and years for the test and standard cultivar. The results for grain yield were statistically analyzed using analysis of variance, a significant difference was tested LSD test for significance level 0.05 and 0.01. To yield grain is calculated and the coefficient of variation (CV).

## RESULTS

Grain yield is a complex trait that besides genetic basis depends on external factors (soil, temperature, rainfall, agricultural) so that the proper selection of cultivars is certainly a decisive factor in achieving high and stable yields. Cultivar Kg Zlatnik has achieved an average return on all the locations in the two years from 8.183 kg / ha which is 400 kg / ha more than the standardcultivar Novosadski 525, which is a highly significant difference (Table 1). The difference was achieved in the first year of study, while in the second year of the two cultivars were at a similar level. The new cultivar has exhibited a high genetic potential for yield of over 10 t/ha in Novi Sad and Pancevo in 2008/2009. And at other locations showed remarkable fertility expandable production on large areas.

The application of modern agricultural technology and increasing yields is due to the shortening of the stem in field crops (Borojević, 1981). Reduced height is the direct component of resistance to lodging. Lodging of barley depending on the phase of growth and developmental cause losses during harvest and deteriorate the quality (Hmurec, 1985). Cultivar Kg Zlatnik was on average 85.3 cm high which is 2.9 cm lower than the standard cultivar and proved to be somewhat more resistant to lodging than the standard with a score of 1.85 (Table 2).

Length of the growing season was one of the factors that affect yield. In our production areas cultivars shorter vegetation realize higher grain yields as avoiding the negative impact of the June temperature (Pržulj et al., 1999). Cultivar Kg Zlatnik heading is slightly earlier than the standard cultivar Novosadski 525 (0.05 days on average) (Table 2).

*Table 1. Grain yield cultivar Kg Zlatnik compared to the standard Novosadski 525 in experiments Varietal Commission in 2008-2010.*

Locations	Year	Grain Yield (kg/ha)	
		Kg Zlatnik	Novosadski 525
Kikinda	2009/2010	8.804	7.987
Kragujevac	2008/2009	5.466	4.364
Novi Sad	2008/2009	10.672	9.584
	2009/2010	8.185	8.410
	x	9.429	8.997
Pančevo	2008/2009	10.362	9.132
	2009/2010	4.740	4.753
	x	7.533	6.942
Sr. Mitrovica	2008/2009	9.254	9.094
	2009/2010	8.488	8.645
	x	8.871	8.870
Sombor	2008/2009	9.740	9.700
	2009/2010	6.392	6.110
	x	8.066	7.905
Zaječar	2008/2009	9.264	8.772
	2009/2010	6.866	6.846
	x	8.065	7.809
x	2008/2009	9.120	8.441
	2009/2010	7.246	7.125
x (2008/09-2009/10)		8.183**	7.783
LSD	0.05	321	
	0.01	396	
Cv		9.25	

Diseases which appear on the upper leaf and the chaff the grain filling period can have a negative effect on the transport system and to significantly reduce the yield. Therefore, the resistivity of the most important disease of major importance. Kg Zlatnik was more resistant to powdery mildew (*Erysiphe graminis hordei*) of standards while both varieties showed significant resistance to leaf rust (*Puccinia hordei*). And in tests for resistance to winterkill, sorta Kg Zlatnik had a 100% plant survival which is 10% better than the standard (Table 2).

*Table 2. The most important agronomic and physiological characteristics of winter barley cultivar Kg Zlatnik*

Characteristics	Kg Zlatnik	Novosadski 525
Plant height (cm)	85.3	88.2
Time of heading (+/- days)	-0.05	/
Resistance to lodging (0-9)	1.85	2.00
Resistance to winterkill (% of survivors)	100	90
Disease resistance (% infected)		
Diseases	/	/
Leaf rust ( <i>Puccinia graminis hordei</i> )	0	5
Powdery mildew ( <i>Erysiphe graminis hordei</i> )	5	40

Seed size and representation of fractions of grain is positively correlated with good technological properties of malt (Pržulj et al., 1996). Cultivar Kg Zlatnik has a share first class seeds 92.2% and its cultivar with large and uniform grain. According Denčić (1992), beer barley cultivars should have a mass of 1000 grains over 42g, hectoliter mass 60-65 kg / hl and the lower protein content. Weight of 1000 grain cultivar Kg Zlatnik is 45.6 g and lower than the standard (48.6 g). Hectoliters also meets the criteria beer industry (75.7 kg / hl in natural and 76.10 kg/hl in first class seeds). The protein content was decreased by 0.8% in comparison to the standard (see Table 3). Germination after three and five days was high (99%), which has great influence on the yield of malt. According to Bishop's scale and new and standard cultivars have more than 80% of the extract of grains.

According KOS (1974) quality malt should have the following parameters: Kolbachs coefficient of 35-41, Hartongs coefficient of 36 and higher, the viscosity of the wort 1.58 or less, the malt color 2.6-4.4 EBC units, sugar time 10-15 min, and the malt pH 5.6-5.9. Loss micromalting cultivar Kg Zlatnik is 18.47% d.m. which is higher in comparison with a standard (14.27% d.m.). The content of extract in fine milling is 78.69% d.m. and the greater the value of the standard (76.78% d.m.). Cytolytic and proteolytic decommissioned malt and protein as measured Kolbach's and Hartong's coefficient show slightly lower values with Kg Zlatnik (Kolbach's coefficient 34.22 and Hartongs coefficient 31.88) and a standard cultivar relation to an optimum, which is probably the effect was unfavorable conditions. The viscosity of malt is 0.56 and is significantly lower than Novosadski 525 (1.840). All these data indicate that grain cultivar Kg Zlatnik can be used as a good raw material for the production of malt. The results of analysis and the micromalting malt are shown in Table 3.

*Table 3. Characteristics of grain and malt cultivar of winter barley Kg Zlatnik compared to the standard Novosadski 525 in Novi Sad in 2008/2009.*

CHARACTERISTICS		Novi Sad	
		Кг Златник	Новосадски 525
<b>PHYSICAL CHARACTERISTICS</b>			
1	Hectoliter mass the natural sample (kg hl)	75,70	72,10
2	Hectoliter mass and class (kg hl)	76,10	74,65
3	1000-grain weight (g d.m.)	45,6	48,6
4	Assortment:		
	on 2,8 screen (%)	60,6	79,0
	on 2,5 screen (%)	31,6	17,4
5	First class (%)	92,2	96,4
<b>CHEMICAL TECHNOLOGY CHARACTERISTICS</b>			
6	Grain moisture (%)	12,3	12,6
7	Protein (%d.m.)	10,1	10,9
8	Germination after 3 days (%)	85	76
9	Germination after 5 days (%)	99	99
10	Extract the Bishop (%d.m.)	82,84	82,27
<b>MICROMALTING</b>			
11	Moisture of first wettability (%)	35,34	36,85
12	Moisture of second wettability (%)	43,11	44,97
13	Moisture of third wettability (%)	50,80	50,25
14	Moisture green malt (%)	51,55	51,29
15	Moisture malt (%)	4,27	4,34
16	Total losses (%C.M.)	18,47	14,27
17	Loss of breathing (%C.M.)	9,77	9,71
18	Loss of the germ (%C.M.)	8,70	4,56



ANALYSIS OF MALT			
19	Extract fine (% d.m.)	78,69	76,78
20	Sugar time (min)	10-15	10-15
21	Cleanness of malt	sl. opalna	sl. opalna
22	Color of malt (EBC units)	3,5	3,5
23	Filtration speed (min)	13	14
24	pH malt	5,31	5,15
25	Soluble nitrogen (mg/100 ml)	63,00	63,70
26	Viscosity (mP s 8,6% e)	0,56	1,840
27	Crude extract (% d.m.)	76,90	73,93
28	Extract difference (% d.m.)	1,79	2,84
29	KOLBACH coefficient (%)	34,22	31,82
30	HARTONGS coefficient – VZ 45°C (%)	31,88	31,97

## CONCLUSION

The new cultivar Kg Zlatnik in the two-year trial Varietal Commission had grain yield 8.183 kg / ha, which is 400 kg / ha more than the standard cultivar. Kg Zlatnik has a slightly lower stem (to 2.9cm) and is slightly more resistant to lodging than Novosadski 525 and the earliness of the same level. Powdery mildew resistance is significantly increased, while the resistance against leaf rust of a standard. At the level of standard cultivar and resistance to winterkill. Resistance to most diseases can contribute to the use of these cultivar in organic production.

All the physical and chemical characteristics of the variety Kg Zlatnik meet the criteria for the beer industry (proteins 0.8% lower than standard). The parameters that determine the quality of malt are the level or better than the standard of the so Kg Zlatnik coin may be used as raw materials in the beer industry in the preparation of malt quality.

## REFERENCES

1. Becker, H.: *Pflanzenzctung*. Ulmverlag, 327S, 1993.
2. Borojević, S.: *Principi i metodi oplemenjivanja bilja*, Ćipranov univerzitet, Novi Sad, 239-240, 1981.
3. Denčić, S., Mikić Katica, Momčilović Vojislava: *Rezultati rada na genetici i oplemenjivanju ječma*. V Monografija Pivski ječam i slad. Izdavač „20. Oktobar” Sladara, Bačka Palanka, 52-64, 1992.
4. Djekic Vera., Milivojevic Jelena., Jelić, M., Popović, V., Branković Snezana, Perisić Vesna, Bratković, K.: *Parametri rodnosti razlicitih sorti jarog ječma*, XIX Savetovanje o biotehnologiji, Zbornik radova, Vol. 19. (21), Čačak, 41-45, 2014.
5. Koš. T.: *Pivarski priručnik*. Poslovno udruženje industrije slada i piva. Beograd, 1974.
6. Maksimović, D., Krstić, M.: *Rodnost i kvalitet zrna i slada novih linija jarog i ozimog dvoredog ječma*, Zbornik radova Instituta za strna žita Kragujevac, 10, 147-155, 1990.
7. Pržulj, N., Mikić Katica, Momčilović Vojislava: *Osobine sorte jarog pivskog ječma Vihor*. Pivarstvo, 29, 2, 71-75, 1996.
8. Pržulj, N., Momčilović Vojislava: *Stanje i perspektive u oplemenjivanju pivskog i stočnog ječma*, Zbornik radova Instituta za ratarstvo i povrtarstvo, Novi Sad, 31, 111-120, 1999.
9. Pržulj, N., Momčilović Vojislava: *Cultivar x year interaction for winter malting barley quality traits*. In B. Kobiljski (Ed) *Conventional and Molecular Breeding of Field and Vegetable Crops*, 24-27. November 2008, Novi Sad, Serbia. 418-421, 2008.
10. Pržulj, N., Momčilović Vojislava: *Značaj i oplemenjivanje ječma i ovs*, Ratarstvo i povrtarstvo 47, 33-42, 2010.
11. FAOSTAT. 2012. <http://fostat.fao.org/faostat/>
12. Hmurec, K. I.: *Sbornik naucnih trudov Belorus*. XII zeljadelija, 29. 45-47, 1985.
13. Ullrich, E.S.: *Significance, adaptation, production and trade of barley*. Barley: Production, Improvement and Uses, 3-13, 2011.

**Kamenko Bratković<sup>1</sup>, Milivoje Milovanović<sup>1</sup>, Vladimir Perišić<sup>1</sup>,  
Vera Đekić<sup>1</sup>, Kristina Luković<sup>1</sup>**

<sup>1</sup> Centar za strna žita, Kragujevac, 34000 Kragujevac, Srbija  
kamenko@kg.ac.rs

## **NOVA SORTA OZIMOG DVOREDNOG JEČMA KG ZLATNIK**

### **Apstrakt**

Nova sorta ozimog dvorednog ječma Kg Zlatnik selekcionisana je u Centru za strna žita u Kragujevcu i priznata od strane Sortne komisije 2012. godine. U dvogodišnjim ispitivanjima imala je prosečan prinos od 8.183 kg/ha što je značajno više od standard Novosadskog 525. Odlikuje se čvrstom, elastičnom stabljikom. U proseku je bila niža za 2.9 cm i otpornija na poleganje u odnosu na standard. Posедуje značajnu otpornost na bolesti i štetočine i preporučuje se za korišćenje u organskoj proizvodnji. Srednje je rana sorta i pogoduju joj intenzivni uslovi proizvodnje. KG Zlatnik ima krupno i ujednačeno zrno visoke hektolitarske mase i niskog sadržaja proteina što je uz karakteristike slada možemo smatrati pivskom sortom i kvalitetnom sirovinom za dobijanje slada.

**Ključne reči:** *dvoredi pivski ječam, sorta, prinos, kvalitet*