

GRAIN YIELD AND QUALITY OF BREAD WHEAT VARIETIES UNDER THE AGROECOLOGICAL CONDITIONS OF DOBROUDJA REGION

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Abstract

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The field experiment was conducted in the selected area of Uzovo village, Dobrich area in the period 2004 – 2007. The test was performed by means of a block method with four replications; experimental field area – 15 m² after sunflower predecessor. The following wheat varieties were tested; Albena, Pryaspa, Enola and Karat. The aim of the study was to establish the grain yield and quality of four Bulgarian bread wheat varieties, grown in the region of Dobroudja. The analysis of the results showed that under the agroecological conditions of Dobroudja region the highest grain yield was obtained from Karat variety – 6000 kg ha⁻¹, followed by Albena – 5300 kg ha⁻¹ and the lowest one – from Enola variety 5130 kg ha⁻¹. The test weight of the investigated varieties is close values, witch indicates that it is in effect – largely on the weather conditions of the year, rather than the variety. The thousand kernel (grain) weight and wet gluten content of Albena variety were highest (50.7g and 28.0%) and lowest of Enola – (46.51g and 26.0%). The lowest values of relaxation of gluten reported with the variety Albena – 7.3 mm and the highest – with the Karat variety – 9.8 mm.

Key words: wheat, grain yield, test weight, thousand grain weight, gluten

Introduction

The production possibility of wheat is determined by the variety, environmental factors as well as by the technology of growing.

The agroecological and the climatic conditions in the separate regions of the country influence the development and productivity of plants (Delibaltova and Ivanova, 2006; Tsenov et al., 2004).

The right choice of the wheat varieties and the proper regional distribution, as well as their growing by strictly following the agrotechnical practices, are of vital importance for the yield amounts and the quality

of the produce obtained (Delibaltova et al., 2009; Ivanova et al., 2007; Nankova and Penchev, 2006; Yankov, 1999). That necessitates the constant introduction of new varieties that are the most suitable and efficient for the separate microregions of the country.

The aim of the study was to establish the grain yield and quality of four Bulgarian bread wheat varieties, grown in the region of Dobroudja.

Material and Methods

A field experiment with wheat was carried out on the experimental field of the village of Uzovo, Dobrich

area during the period 2004 – 2007. The test was performed by means of a block method with four replications; experimental field area – 15 m².

Albena, Pryaspa, Enola and Karat varieties were studied with sunflower predecessor. All the stages of the established technology for wheat growing were followed. The grain yield is determined with standard grain moisture of 13%.

The indices grain yield (kg ha⁻¹); test weight (kg); thousand kernel (grain) weight (g); wet gluten content (%); relaxation of gluten (mm) were determined.

For the purpose of determining the quantity dependence between the studied indicators, the experimental data was processed according to the Anova Method of dispersion analysis, and the differences between the variants were determined by means of the Duncan's Multiple Range Test (Duncan, 1995).

The period of the research is characterized with variety of temperature and rainfall conditions which enables to evaluate the reaction of the studied varieties in accordance with their quality characteristics under different agricultural and climatic conditions (Figure 1).

Characteristics features of the year 2005 are comparatively warm autumn with low moisture during the period of germination and tillering. December, January and February are wet, on which the good level of moisture is based. During the period of the spring veg-

etation (March-April) there was a period of drought while the period of grain filling and forming was with enough rainfall, close to the climatic rates.

During the year 2006 the rainfall is uneven, with months of high moisture (March and May) and dry January. According to the temperature, it is very close to the climatic rates, except January during which month the temperature is -3.4°C or with 3°C lower.

As far as the climate is concern the year 2007 is especially specific. It is characterized with too low rates of moisture not only during autumn – winter period but also during the period of active vegetation. The low rates of rainfall are combined with high temperatures, especially during the winter period.

The period of study (2004-2007) comprised years, which differed significantly concerning the major meteorological factors (air temperature and precipitation sum) having an effect on wheat yield and quality.

Results and Discussion

The total analysis of the results shows that the studied varieties react in a different way according to the grain yield during the three years of the experiment (Table 1). During the separate years of the experiment the highest is the productivity from Karat – 6100, 5900 and 6000 kg ha⁻¹ respectively for 2005, 2006 and 2007.

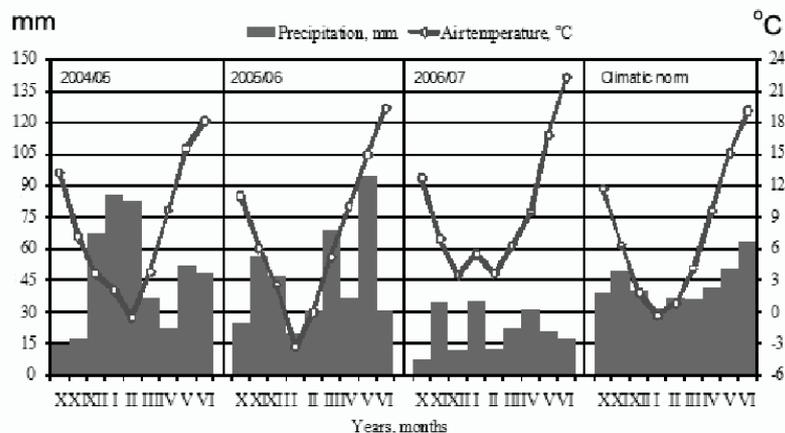


Fig. 1. Meteorological data for the years of the investigation

Table 1
Grain yield, kg.ha-1

Variety	Years of study			Average
	2004/05	2005/06	2006/07	
Albena	5300 ^a	5700 ^b	4900 ^c	5300
Pryaspa	5400 ^b	5800 ^c	4600 ^b	5270
Enola	5700 ^c	5400 ^a	4300 ^a	5130
Karat	6100 ^d	5900 ^d	6000 ^d	6000
LSD 5%	80.6	95.0	295.0	

In the first experimental year the lowest is productivity of Albena variety – 5300 kg ha⁻¹, and in the second and the third years – from Enola variety (5400 and 4300 kg ha⁻¹).

The differences among varieties were statistically significant.

During the period of study (2004-2007) Karat variety realized the yield of 6000 kg ha⁻¹ in average and it surpassed the varieties Albena and Pryaspa by 13.2 and 13.8%, respectively. The grain yield obtained from Enola variety was 5130 kg ha⁻¹ and it was less than the yields from all the other varieties included in the experiment by 2.7 to 17.0%.

The results from analyses of variance over three years for the grain yield are presented in Table 2. It was found that the effects of varieties (V) and year (Y) on the yield were significant. The interaction (V x Y) was also statistically significant. The test weight of the investigated varieties is close values; which indicates that it is in effect – largely on the weather conditions of the year, rather than the variety (Table 3).

The highest values of the characteristic test weight were established in the first experimental year (2005), in the tested varieties varied from 77.2 kg (Albena) to

82.3 kg (Karat). The lowest values of the characteristic test weight were established in the last year of the study (2007), from 77.2 to 78.4 kg. It showed that the low amount of rainfall during the vegetation has a negative influence on grain formation.

In average, during the three-year period of study, the test weight of all investigated varieties varied from 79.5 kg of the Karat variety to 78 kg of Albena variety. It showed that the drain is considered to be good for flour producing.

The thousand kernel (grain) weight is one of the important indirect indicators, characterizing grain properties, its technological value as well as its quality regarding using it as sowing material. This indicator characterized its filling up as well as its thickness.

The thousand kernel (grain) weight changes under the influence of weather conditions during the year (Table 4).

In the most favorable for wheat year (2005) the values of this characteristic were within the limits of 47.25 to 54.63g. Statistically proven, the lowest ones were those of variety Karat and the highest – of Albena. The results of the varieties Pryaspa and Enola had quite close values and they were statistically insignificant.

In the second experimental year (2006) the values of thousand kernel weights varied from 45.97 to 51.72g, i.e. they were by 3.8 % lower in average in comparison with the previous year. Mathematical processing of data showed that variety Karat significantly fell behind Albena and Pryaspa by 7.0 and 10.7%. The lowest the values of this characteristic were realized by variety Enola – 45.97g.

In the most unfavorable (dry) for wheat year (2007) the thousand kernel weight in the investigated variety

Table 2
Analysis of variance for grain yield for the period 2004 – 2007

Source of variation	Sum of square SS	DF	Mean square MS	Sig of F	η
Varieties – (V)	4947500.00	3	1649166.70	0.000	59
Years – (Y)	3095000.00	2	1547500.00	0.000	70
Interaction (VxY)	1825000.00	6	304166.67	0.013	47
Residual	2100400.00	24	87516.67		

Table 3
Test weight, kg

Variety	Years of study			Average for the variety
	2004/05	2005/06	2006/07	
Albena	77.2 ^a	78.5 ^a	78.4 ^b	78.0
Pryaspa	79.4 ^{ab}	80.3 ^b	77.6 ^{ab}	79.1
Enola	80.1 ^b	79.4 ^{ab}	77.8 ^{ab}	79.1
Karat	82.3 ^{bc}	79.1 ^{ab}	77.2 ^a	79.5
LSD 5%	3.1	1.4	0.88	
Average for the year	79.8	79.3	77.7	

ies was from 43.44 to 48.64 g, i.e. they were by 10 and 6% lower in average in comparison with the previous years.

Out of all the investigated varieties smallest the thousand kernel weight, in average for the three years, was established in variety Enola – 46.51 g and the biggest - formed by variety Albena – 50.70.

Meteorological conditions exert certain influence on the amount of gluten, thus the amount of gluten is the highest during the first and the third years of the experiment, and during the two years due to the dry weather during the period of filling of the grain (Table 5).

It has been established that during the drier years protein content of grain is higher, hence it follows that gluten is directly related to protein content as it itself is

Table 5
Wet gluten content, %

Variety	Years of study			Average for the variety
	2004/05	2005/06	2006/07	
Albena	29,0 ^c	27,0 ^c	28,0 ^c	28.0
Pryaspa	27,0 ^a	26,0 ^b	29,0 ^d	27.3
Enola	27,0 ^a	25,0 ^a	26,0 ^a	26
Karat	28,0 ^b	27,0 ^c	27,0 ^b	27.3
LSD 5%	1.0	0.96	0.85	
Average for the year	27.8	26.3	27.5	

Table 4
Thousand kernel (grain) weight, g

Variety	Years of study			Average for the variety
	2004/05	2005/06	2006/07	
Albena	54.63 ^c	50.00 ^c	47.37 ^b	50.70
Pryaspa	50.20 ^b	51.72 ^d	43.44 ^a	48.45
Enola	49.68 ^b	45.97 ^a	43.89 ^a	46.51
Karat	47.25 ^a	46.73 ^b	48.64 ^b	47.54
LSD 5%	2.18	0.22	2.26	
Average for the year	50.44	48.61	45.84	

a protein component.

During 2006 which is characterized with good waterfall supply during the period of formation process of the grain, the amount of gluten is the lowest – 26.3 %.

In the first experimental year (2005) the wet gluten content varied from 27.0 mm in Enola and Prqaspa varieties to 29 mm in Albena. It was statistically proven that Albena variety surpassed by 5.5 % in average all the other studied varieties.

In the second year of the study (2006) the lowest values of the characteristic wet gluten content were reported in Enola variety – 25.0%. Mathematical processing of data showed that this variety significantly fell behind Pryaspa and Albena by 4.0 and 8.0 % respectively.

Table 6
Relaxation of the gluten, mm

Variety	Years of study			Average for the variety
	2004/05	2005/06	2006/07	
Albena	6,5 ^a	9,1 ^a	6,4 ^a	7.3
Pryaspa	7,3 ^b	9,4 ^a	6,5 ^b	7.7
Enola	7,8 ^b	9,1 ^a	6,4 ^a	7.8
Karat	9,5 ^c	9,7 ^b	10,1 ^c	9.8
LSD 5%	0.81	0.21	0.95	
Average for the year	7.8	9.3	7.4	

The following indices show the influence of the variety on the amount of wet gluten. On the average for the three years of the experiment the highest is the formation of wet gluten of Albena variety – 28.0%, while the lowest is of Enola variety – 26.0%. The results obtained were statistically significant.

In addition to amount of gluten its quality is determinative too for the bread producing and baking properties of certain grain yield. The main property determinative for the quality of gluten is its relaxation.

In this study the relaxation of gluten of the four varieties during the three years of the experiment is according to standard, i.e. it is lower than the maximum of 10 mm over which standard the grain is no good for bread making. Karat variety which in 2007 shows relaxation of the gluten 10.1 mm is an exception of this standard (Table 6).

The lowest relaxation of the gluten was obtained in the last year of the study (2007) due to the dry weather during the period of filling of the grain - 7.4 mm on the average for all the varieties.

The highest relaxation of the gluten were obtained in the second experimental year (2006) which is characterized with good waterfall supply during the period of formation process of the grain and the values of this characteristic varied from 9.1 to 9.7 mm. The lowest is the quality of the gluten formed by variety Karat when relaxation of gluten is significant highest – 9.7 mm. The results of the varieties Pryaspa, Enola and Albena had quite close values and they were statistically insignificant.

During the period of study (2004-2007) the studied varieties form gluten of different quality, the lowest is relaxation of Albena variety -7.3 mm while the highest is of Karat variety – 9.8 mm.

Conclusions

Under the agroecological conditions of Dobroudja region the highest grain yield was obtained from Karat variety – 6000 kg ha⁻¹, followed by Albena – 5300 kg ha⁻¹ and the lowest one – from Enola variety 5130

kg ha⁻¹.

The test weight of the investigated varieties is close values; witch indicates that it is in effect – largely on the weather conditions of the year, rather than the variety.

The thousand kernel (grain) weight and wet gluten content of Albena variety were highest (50.7g and 28.0%) and lowest of Enola – (46.51g and 26.3%).

The lowest values of relaxation of gluten reported with the variety Albena – 7.3 mm and the highest – with the Karat variety.

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