Turkish Journal of Agricultural and Natural Sciences
Special Issue: 2, 2014

TÜRK
TARIM ve DOĞA BİLİMLERİ
DERGİSİ

TURKISH
JOURNAL of AGRICULTURAL
and NATURAL SCIENCES

www.turkjans.com

Study the influence of the climatic conditions and mineral nutrition to the quality indicies of the winter wheat variety Enola

Emil PENCHEV , Ivanka STOEVA , Necho NANKOV
Dobroudza Agricultural Institute , General Toshevo 9520
*Corresponding author: e-mail : emo_ap@mail.bg

Abstract

In the article is studied the influence of the climatic conditions and mineral nutrition by two crop rotations and monoculture to the quality indices of the winter wheat variety Enola . ANOVA 3 statistical procedure is applied for estimating the influence of the studied factors to the quality indices . Their influence is proved with different level of statistical significance . The optimal variants of mineral nutrition by this experiment are determined using principal component analysis .

Key words : winter wheat ,mineral nutrition , quality indices

Introduction

Wheat is a main crop in the Dobroudja region and production of wheat grain is of decisive economic importance for our country. The specific environmental conditions ofthe region characterised by predominant comparatively rich soils and dry climate imposethe necessity to systematically and thoroughly study the effect of mineral fertilization on this crop . Winter wheat variety Enola is the most popular in Bulgaria in the last years for the farmers . This variety give good results also in other countries in Balkan area as Turkey and Macedonia .

The aim of this study is to estimate the yield results in three years period , applieng four levels of treatment with nitrogen , phosphorus and potassium by the climatic and soil conditions of Dobroudja region . They are characterised the most important quality indices and scpecified their relationships

Matherials and Methods

The experiment is taken during the period 2010 – 2013 with the most actual winter wheat variety Enola . The design is split – plot in 3 replications . The plot is latin rectangle with area 10 m^2 . The experiment contain 4 levels of mineral nutrition with nitrogen , phosphorus and potassium by two crop rotation /wheat-maize/ and monoculture . They are studied the following important indices – yield, wet gluten in 70% flour, stability of dough, farinograf quality number, bread volume, H:D

The experimental data are analysed by the statistical packagies SPSS 17.0 and BIOSTAT 6.0 .
The applied model of disperssion analysis is :

Yijk = X.. + Ai + Bj + Ck+ (AB)ij + (AC)ik + (BC)jk + (ABC)ijk + Eijk

where X.. is the average mean , Ai the i $_{the}$ level of factor A , Bj is the j $_{the}$ level of factor B , Ck is the k $_{the}$ level of factor C and the interaction between the factors and Eijk is the error .

The relations between the quality indicies are studied by correlation analysis . The influence of the studied quality indices is estimated by principal component analysis

Results and Discussion

The results from the dispession analysis are reflected in table 1 .

The influence of all studied factors on the yield of Enola are statistical significant by p=0,001 of the alternative hypotesis , also the interaction between the factors climatic conditions and mineral nutriton .

In fig.1 is shown the yield of Enola during the period 2010 – 2013 under application of four levels of mineral nutrition .

The climatic conditions during the years 2010 , 2012 are more favourable for the yield results of Enola . This years are characterized with good winter reserve humidity and normally rainfall during the spring . In 2011 was observed a dry period during the spring and more rainfall during the harvest . This is the reason that in 2010 and 2012 the yields are higher in comparison with 2011 . The received results of the yield prove that the combination of fertilizers $N_{12}P_{10}K_6$ is the optimal for wheat production .

The influence of all factors on the sedimentation is proved with different level of statistical significance . also the interaction between climatic conditions and mineral nutrition . The same results are observed by the indices wet gluten contain and bread volume . By stability of dough and farinograf quality number effect has only the mineral nutrition . The studied factors haven't any influence on the H:D.

The relations between the quality indices are estimated by correlation analysis .

In most publications is proved that the relations between yield and quality indices by the winter wheat are negative . In tables 2 and 3 are published the correlation coefficients between the studied quality indices . It is interesting to underline that the relation between H:D and the other indices is negative by monoculture and positive by two crops rotation . By both treatments the relations between the other quality indices are positive . To specify all this relations is applied a principal component analysis . The received results are reflected in table 4 . To estimate the most important for the quality of the wheat variety Enola is applied principal component analysis based on correlation matrix ,eigenvalues , varimax . unrotated axis. The main index is the volume of the bread.

Table1 . Mean of square values of the studied indices

Indices	MSA	MSB	MSC	MSAxB	MSAXC	MSAxBxC	MSE
Yield,t/ha	12765.1 ^{c}	8795.4 ^{c}	3541,4 ^{b}	7366.9 ^{c}	1264.5	899.7	699..6
Sedimentatin,ml	214.3 ^{b}	66.9 ^{a}	188.7 ^{b}	139.5 ^{b}	28.7	33.1	19.4
Wet gluten in 70% flour,%	164.9 ^{c}	113.4 ^{c}	152.7 ^{c}	102.2 ^{b}	87.5 ^{a}	54.3	12.9
Stability of dough,min	17.3	47 ^{a}	19.6	10.3	8.9	6.4	7.6
Farinograf qualitynumber, conv.un.	1820.2	7498.7 ^{a}	1766.3	1233.1	929.6	834.5	965.6
Bread volume,ml	4657.7 ^{a}	53914.5^{c}	3946.5 ^{a}	2764.3	1728.5	1022.7	969.8
H:D	2.4	6.8	2.2	1.7	0.7	0.3	1.1
df	2	3	1	6	2	6	35

a – statistical significant by p=0,05 ,, b – statistical significant by p=0,01, c – statistical significant by p=0,001 ,A – climatic conditons .B mineral nutrition , C treatment

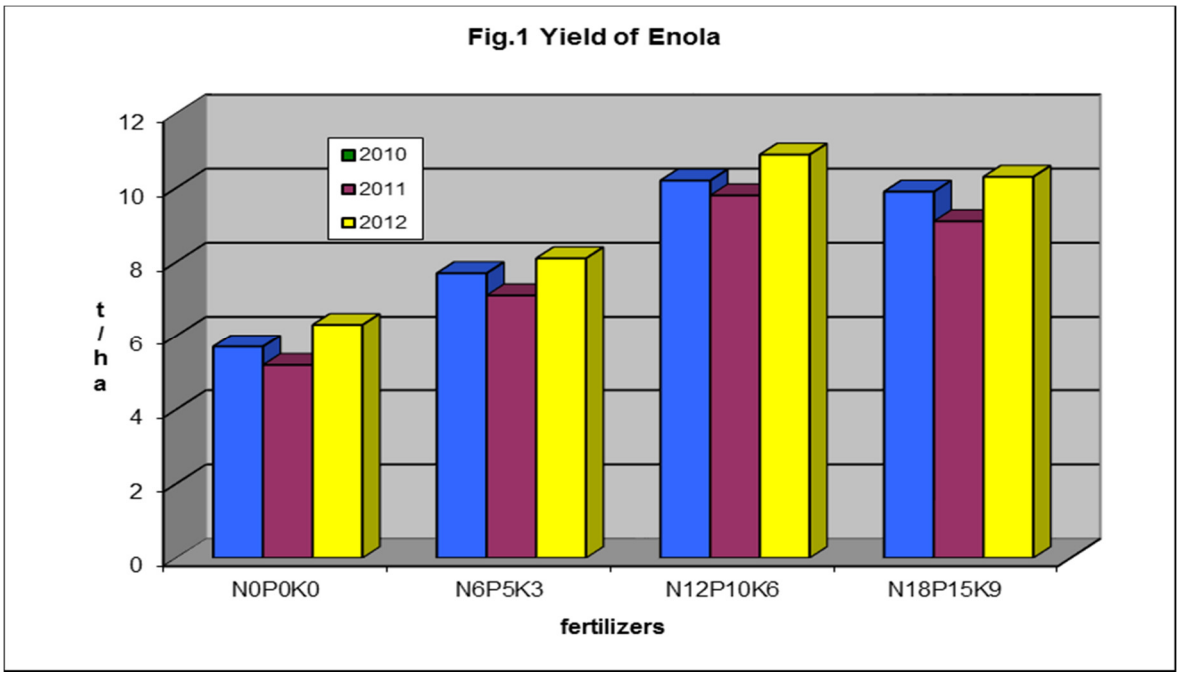
Table2 . Correlation coefficients between the quality indices of Enola by monoculture

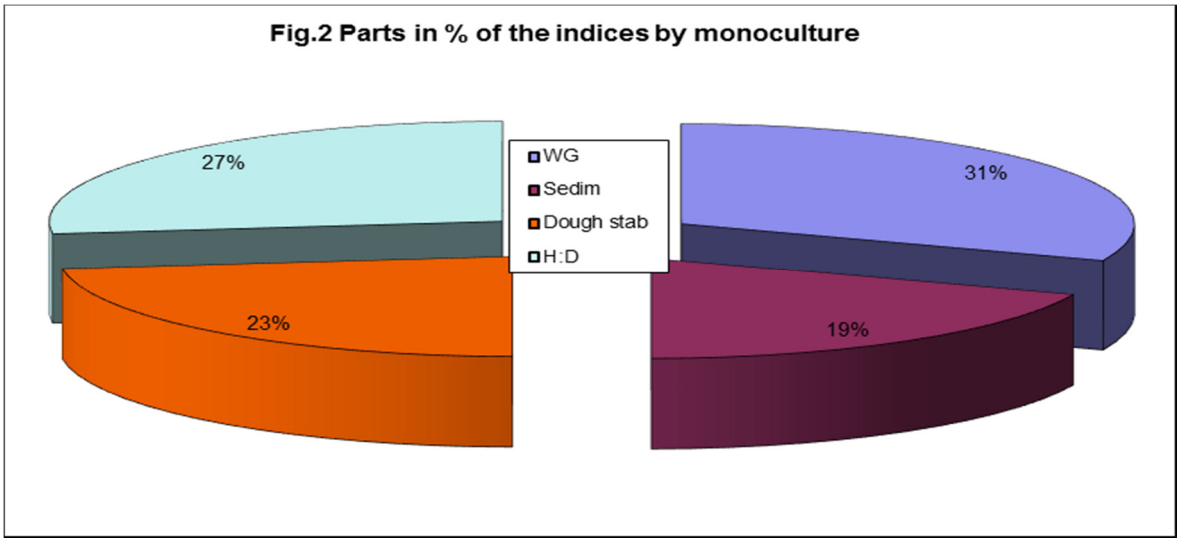
Indices	Sedimentation ,ml	Wet gluten in 70% flour,%	Dough Stability,min	Farinograph quality number, conv.un.	H:D
Bread volume,ml	0.795	0.722	0.695	0.625	-0,522
Sedimentation,ml		0.717	0.628	0.619	-0.514
Wet gluten in 70% flour,%			0.639	0.585	-0.502
Dough stability,min				0.743	-0.495
Farinograf quality number, conv.un.					-0.482

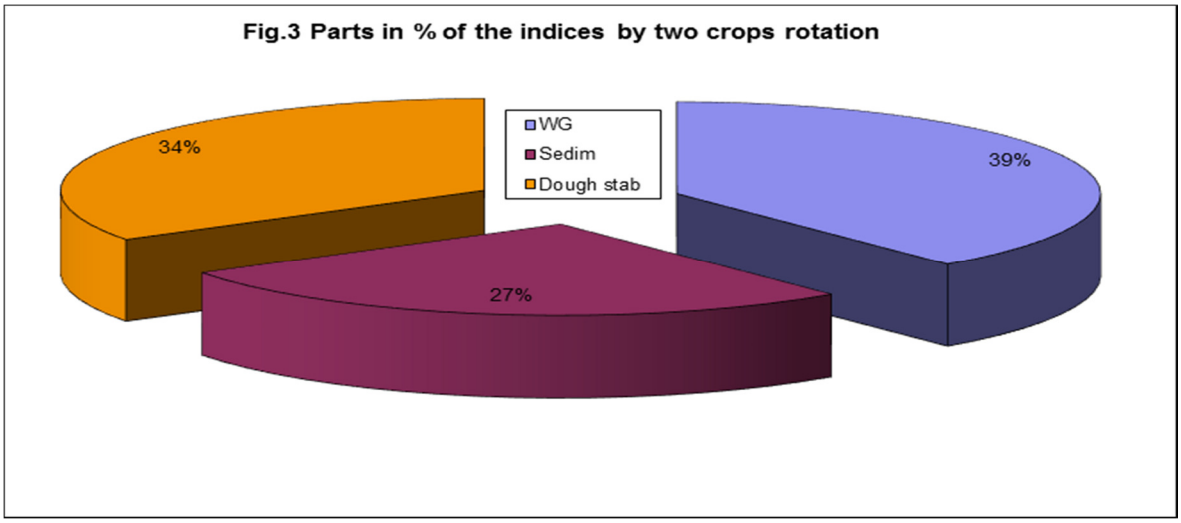
Table 3. Correlation coefficients between the quality indices of Enola by two crop rotations

Indices	Sedimentation,ml	Wet gluten in 70% flour,%	Dough Stability, min	Farinograph quality number, conv.un	H:D
Bread volume,ml	0.672	0.634	0.564	0.595	0.642
Sedimentation,ml		0.704	0.588	0.625	0.741
Wet gluten in 70% flour,%			0.516	0.617	0.552
Dough stability,min				0.772	0.672
Farinograph quality number,conv.un					0.654

By monoculture the most important components are wet gluten contain , dough stability . H:D and sedimentation.







Negative is the influence of the farinograph quality number . Their part in percent is shown in fig .2 .By two crops rotation (fig.3) the main components are sedimentation , wet gluten contain and dough stability . In this case farinofraph quality number and H:D have a negative influence . Interesting is the estimation of the components of the H:D. By monoculture is in negative correlation with the volume of bread , but his part is 27 % and by two crops rotation the correlation is positive and negative part . This fact is possible to explain with indirect relations between the studied indices.

Table 4. Components score , coefficients matrix

Indices	Monoculture		Two crops rotation	
	Component 1	Component 2	Component 1	Component 2
Bread volume,ml	0.524	-0.212	0.378	0.125
Wet gluten in 70% flour,%	0.833	0.185	0.557	-0.205
Dough stability,min	0.610	0.229	0.489	-0.196
Farinograph quality number, conv.un	-0.180	0.356	-0.228	0.274
H:D	0.721	-0.233	-0.254	0.375

Conclusions :

1. The norm of mineral nutrition $N_{12}P_{10}K_6$ is a favourable for receiving of a high yield of Enola .
2. By monoculture the correlation coefficients between the studied indices are positive except the H:D and by two crops rotation all relations are positive .
3. The main indices which form the quality of winter wheat variety Enola are wet gluten in 70% flour, sedimentation and dough stability

References :

1. Abamu, F.J. , E. A. Akinsola & K. Alluri . Applying the AMMI models to understand genotype-by-environment (G E) interactions in rice reaction to blast disease in Africa. International Journal of Pest Management pp 239-245 .
2. Cornelius, P.L.;J. Crossa . Prediction assessment of shrinkage estimators of multiplicative model for multi-environment cultivar trials. Crop Science, v.39, p.998-1009, 1999.
3. Dias, C.T.S.; Krzanowski , W.J. Model selection and crossvalidation in additive main effect and multiplicative interaction (AMMI) models. Crop Science, v.43, p.865-873, 2003.
4. Nachit,M.M., G. Nachit, H. Ketata, H. G. Gauch and R. W. Zobel. Use of AMMI and linear regression models to analyze genotype-environment interaction in durum wheat . TAG Theoretical and Applied Genetics . Volume 83, Number 5, 597-601 .

5. Lee, Eun-Joo (2004). *Statistical Analysis Software for Multiplicative Interaction Models.* Unpublished doctoral dissertation, Kansas State University, Kansas.

6. Milliken, G. A., & Johnson, D. E. (1989). *Analysis of Messy Data, Volume 2: Nonreplicated Experiments* (2nd ed.).New York: Chapman & Hall.