MATHEMATICAL–STATISTICAL ANALYSIS FOR EVALUATION OF FACTORS TREATMENT OF THE SOIL AND FERTILIZATION ON THE YIELD OF WHEAT

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MATHEMATICAL-STATISTICAL ANALYSIS FOR EVALUATION OF FACTORS TREATMENT OF THE SOIL AND FERTILIZATION ON THE YIELD OF WHEAT

Rumen Bazitov[1], Antoniya Stoyanova[2], Velika Kuneva[3]

Abstract: The aim of the conducted study, based on two-factor analysis of variance, is to assess the significance and power of influence of factors – treatment of the soil and fertilization and their interaction on the productivity of wheat. Data for the [1]yield of irrigated corn were used, which were derived from field trial to study the effect of the treatment of the soil and fertilization on the yield of irrigated grain maize. The experiment was carried out in the experimental field of Agricultural Institute - Stara Zagora during 2009 - 2011 period. The result, by ANOVA method were proven statistically with significant variance of the factor "system of fertilization" (B) on "yield irrigated corn for grain" .

Key words: ANOVA, common wheat, systems of fertilization.

Introduction

One of the main tasks of agriculture in the world and in our country is addressing the food problem. Fertilization is an important and dynamic part of the technology of cultivation of common wheat. Mineral fertilization, together with other elements of the entire agricultural complex of events affects the tolerance of culture in drought at extremely low temperatures, while determine not only fertilizer standards but also the ratio of nutrients in them and phenotypes phase in which are imported. The conditions of mineral nutrition largely determine the possibilities of wheat to realize the genetic potential. The implementation of these cultures at different levels of fertilization is important for the plasticity of different varieties. Fertilization is a decisive event for obtaining high yields of grain in the absence of other limiting factor (Gastol and Lemaize, 2002). A number of studies have found positive impact of mineral fertilization with macronutrients on the quantity and quality of production (Samodova A., 2008, Tontcheva R. et al., 2008). Sided application of mineral fertilizers leads to disruption of the ecological balance and lowering the quality of production (Brzozowska I., 2008). The necessity of adding micronutrients is a problem that is recognized by a long period of time (Blaziak J. et al., 2003; Suwara I. et al 2007). In recent years a number of researchers found in certain arable and vegetable crops influence of organic fertilizer "Humustim" (Vassileva and Kertikov, 2006; B Gramatikov and Koteva, 2006).

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The purpose of this paper is by the two-factor analysis of variance to analyze the impact of the factors tillage and fertilizing systems and their interaction on the productivity of the wheat.

Material and methods

To achieve the objective during the period 2009 – 2011 was displayed field experience in the experimental field of the Agricultural Institute Stara Zagora. The experimental study was conducted with two traditional agricultural crops - common wheat and grain maize, grown under irrigation. Crop rotation is displayed on soil type meadow cinnamon soil. The humus content is 1.18 to 2.11% at the plow layer. In terms of macronutrients that the availability of soil is low in nitrogen (31,3 - 38,1 mg/kg soil), weak stocks absorbable phosphorus (3,1 - 4,3 mg/kg soil) and well stocked with absorbable potassium (42,3 - 48,1 mg/100 g soil). The field experience is held on the block method, the size of the harvested plot 20 m^2. Variants of the study are: 1. V_0- zero control; 2.V_1- $N_{10}P_9K_8$ kg/da; 3.V_2-$N_5P_{4,5}K_4$ + Humustim (40 ml/da); 4. V_3- $N_0P_0K_4$ + Humustim (40 ml/da).

Organic fertilizer Humustim has extensive organic and mineral composition: 12.5% dry matter, which includes 41.05% ash and minerals and organic matter 58.95%, of which 23.4% humic acids 5.00% fulvia acids 7.83% total potassium; 3.00% total nitrogen; 1.14% total phosphorus 3.92% total calcium 1.11% total magnesium. All trace elements (zinc, copper, molybdenum, cobalt, boron, sulfur, etc.), Which contained not been added, and are of an organic base. Contents absorb N - NH_4 - 142,8 mg/l; assimilable N - NO_3 - 12,6 mg/l; assimilable P_2O_5 - 400 mg/l; teachable K_2O - 10245 mg/l; teachable CaO - 3338 mg/l; absorb MgO - 924 mg/l. The main active ingredient in the organic fertilizer is potassium salts of humic acids. All elements in the composition of Humustim are of natural origin and in mobile forms, making them easy to absorb from vegetative plant parts. Upon removal of the field study are followed agro-technical requirements according to the standard technology of cultivation of Bulgaria.

In each of the crops in crop rotation are investigated two factors: soil tillage (factor A) and systems fertilization (factor B). The test biometric indicator is the yield of the wheat.

Experimental data were subjected to two-factor analysis dispresionen. Statistical data processing is used Microsoft Excel 2003. The assessment of the strength of the influence of factors is calculated on Plohinski (Lakey, 1990). Defined as part of inter-group variation in total variation. Work with the sum of the squares and is calculated as follows:

$$h_x^2 = \frac{D_x}{D_y},$$

where - the sum of the squares of the factors x, - total sum of squares.

Results and discussion

In meteorological terms years, during which he conducted the field study are characterized by uneven distribution of precipitation. The amount of rainfall in two of the experimental years (2008 and 2009) is 16-17% below normal for 85-years period.

The third year of the study is characterized by better moisture security. (table 1). The dynamics of daily average temperatures are not distinguished by extreme values. Measured negative in January 2009-2010 not create stressful conditions. Negative temperatures are not retained and therefore do not reflect negatively on the development of crops. The dynamics of the daily average values do not differ from the dynamics of the measured average daily values for long period.

Tabela 1. Метеоролошка карактеристичне за период 2008-2011 за област Стара Загора

Table 1. Meteorological characteristic for the period 2011-2014 for the area of Stara Zagora

Years	I	II	3	IV	V	VI	VII	VIII	IX	X	XI	XII
	Rainfall, mm											
2008	30.8	0	13	72.6	30	69.1	40.9	8.7	151	17	0.5	35.3
2009	24	14	35.5	8.4	18.6	67.2	57.8	33.2	15.8	74.2	24.4	86.6
2010	46.3	140	48.3	67.3	21	77.6	153	44.5	21.9	95.9	9.4	40.6
2011	84	72	70	15.8	34.4	26.7	40.9	51.7	13.3	70.6	1.3	44.3
	Temperatures, C^O											
2008	-2.1	2.7	9.1	12.9	16.7	21.7	23.6	25.3	18.0	13.2	8.2	4.7
2009	0.1	3.3	6.3	11.7	18.4	22.3	24.6	24.2	19.2	13.9	7.8	4.4
2010	0.7	3.6	6.3	12.4	17.8	21.3	23.5	26.9	20.4	11.4	11.4	3.1
2011	1.3	1.6	6.6	10.9	17.2	21.6	25.3	24.1	21.8	11.4	3.9	2.8

The two-way analysis of variance was used as an appropriate method for assessing the impact of the relevant factors on the yield of common wheat. The results of the dispersion analysis of the influence of factors tillage (A) systems fertilization (B) and their interaction (AxB) on biometric identifiers "extraction" are presented in Table 2.

Табела 2. Анализа варијансе је утицај фактора као што је третман земљишта (А), система ђубрења (Б) на принос пшенице

Table2. Analysis of variance of the influence of factors : treatment of the soil (A), fertilizing systems (B) on the yield of wheat

Variation Source	SS	df	MS	F	P-value	F crit
Processing ground (A) n.s.	311.1	2	155.55	0.13	0.88	3.4
Systems fertilization (B) ***	117001.91	3	39000.6	33.4	0.00	3.01
Interaction (AxB) n.s.	8373.74	6	1395.6	1.19	0.34	2.51
Errors	28030.5	24	1167.9			
***, **, * - proven respectively p≤0.001, p≤0.01 и p≤0.05; n.s. – unproven						

From the results of the biometric indicator "yield" statistically proven at a very high level of confidence p≤0.001 impact factor B - fertilization systems. The influence of factors A and the interaction of two factors statistically unproven.

Once reliably proved the action of the factor "systems of fertilization" on the yield of irrigated corn, assess and power of influence on the resulted lines.
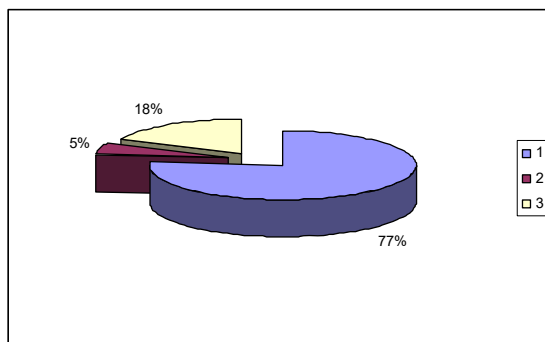
Graf. 1. Снага утицаја (%) системи ђубрења на принос пшенице
Graph. 1. Strength of influence (%) of the systems dressing on yield of wheat.

Conclusion

Based on the conducted two-factor analysis of variance found that factor in systems of fertilization exert a dominant influence on the indicator "extraction", which was statistically demonstrated in p≤0.001. The lowest and unproven mathematical factors are the impact of A-tillage and the interaction of two factors.

References

Brzozowska I. (2008). Macroelement content in winter wheat grain as affected by cultivation and nitrogen application methods. Acta Agrophysica, vol: 11, number:1,pages: 23-32.

Blaziak J., Chwil S. (2003). Effects of foliar application of various mineral fertilization on rates of microelement content in winter wheat. Acta Agrophysica, vol: , number: 85, pages: 39-44.

Gramatikov, B., C. Koteva. (2006). Effect of fertilizer humatniya Humustim on the productivity of some crops. Field Crops Studies, voll III, No3, 413-419.Bg

Gastal, F., G. Lemaize. (2002). Nitrogen uptake and distribution in crops, an agronomical and ecophisiolical perspective. Jurnal of Experimental Botani, Vol. 53, №370.

Lackey, D., 1990, Biometrics, Vыsshaya School, Moscow.

Tontcheva R., Ch. Pchelarova, F. Dimitrova. (2008). Evaluation of the variation in yields of wheat depending on fertilization. Collection of scientific works of Scientific international conference, 1-2 October Kardzhali, Volume III, 138-143. Bg.

Samodova A. (2008). Testing of the ordinary winter wheat varieties in soil and climatic conditions of Pazardzhik. International Conference June 5 to 6, Stara Zagora, 9789549329445 7.

Suwara I., Lenart S., Gawronska-Kulesza A. (2007). Growth and yield of winter wheat after 50 years of different fertilization and crop rotation. Acta Agrophysica, vol: 10, number: 3, pages: 695-704.

Vasileva, V., T. Kertikov. (2006). Influence of fertilization with Humustin on crop quality and yield grain with spring peas. Soil science, agricultural chemistry and ecology, 4, 55-60. Bg.