. STUDY OF THE TILLAGE AND PLANTING INFLUENCE ON THE MAIZE YIELDS.

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Summary:*Sustainability of agricultural production results in reducing the negative trends caused by both climate change and by incorrectly applied technologies for production, which aims to preserve the resource base and maintaining environmental quality. Soils are conditionally renewable natural resource but practically reconstruct in a very long time. Therefore, in order to preserve them relate to non-renewable natural resources. At its core, soil, where they are intended for agricultural use are processed to meet the needs of people and thus change their properties. By applying appropriate ways of tillage and use the potential of plant residues, it is possible to control physical properties. There is a misconception and myth that getting high yields in agriculture can be maintained only with the addition of fertilizer and / or water. High investments made at the entrance of the agricultural production can easily be pointless, if the physical properties of soil are suboptimal or even below the critical level.The physical properties of the soil, it is essential for processing and has its mechanical structure. It closely depend on a number of other properties such as bulk density, ability to retain water, porosity, adhesion, resistance, etc., Which play an important role in the processing and to obtain sustainable yields.*

Introduction

It is estimated that one-sixth of the soils in the world (16-17%) already lost from water and wind erosion, [.....]. This fact has two important consequences in terms of the reduced ability of the public to produce enough food, due to losses in depth and quality of soil and occurrence of side effects such as water pollution and water reservoirs that are associated with erosion.

Drought is a major problem faced by many nations inevitably worldwide. Droughts occur in both regions climate is characterized by heavy rainfall and in areas where rainfall is scarce. Available soil, meteorological, agro-meteorological and hydrological information indicates that droughts have been recorded repeatedly in the 20th century in Eastern Europe and they are part of the climate cycle of Balkan Peninsula, [...]

As a result of the intensification of agricultural production and climate change over the past two decades is increasingly recognized the threat to the Bulgarian and European soils. Only in 2016 reported high values of maximum temperatures during the growing season of plants Figure 1 and in more than 12 vapezha for extreme regions of Dobrich and Ruse, Fig. 2.

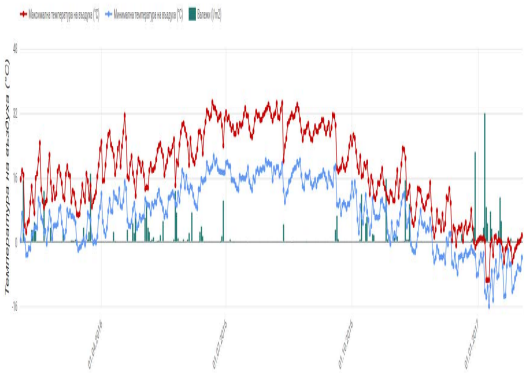


Fig. 1. Maximum and minimum daily temperatures of air region. Lozenets,, Dobrich District

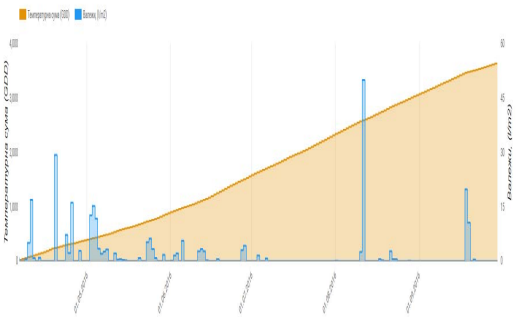


Fig. 2. The act of extreme rainfall and periods of prolonged droughts to the region of. Ruse District

Surveys conducted over the past 10-15 years, as well as regular information studies show a significant reduction in yields. One reason is the general degradation of soil and compacting them at different depths, which covers more than one soil horizon.

However, in modern agriculture there are two worrying trends:

Improving the structure of the machines made in mechanization (compilation of TCM, TLM and MTA) to simultaneously increase the axle load of the running system of energetic machines;

Intensification of crop rotation and move to etc. "Commercial crop rotations."

One example is that legumes have been replaced by cereal such as wheat, barley, sunflower, and partly from maize.

Tillage is one of the main activities of people when growing crops. It is important and invariably unit in all known systems of agriculture - from the most primitive to modern.

By the term "soil tillage" is understood a number of actions to be taken to change the structure in such a way that the conditions for the germination, growth and development of plants are the best in order to obtain optimum yields.

The term "soil structure" is intended to clarify the spatial distribution of soil aggregates, [Dexter, 1988]. What is the purpose of each application to soil to form more large and small spaces (pores), thereby facilitating the penetration of air and water and the development of the root system of the plants.

Tillage is applied between harvesting one crop to the next sowing. The reason is removing the weeds, which is much more modest than crop plants to adverse environmental conditions and develop with higher rates.

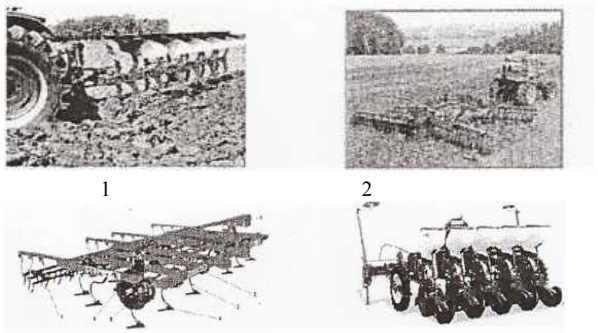
Need more perfect tillage associated with the demands of the times in which we live becomes more urgent as more "cultural" is the cultivation of plants and the higher requirements brought someone in their cultivation.

Material and Method

On the basis of conducted field trials in which it was applied "Strip-till" technology in growing row crops becomes clear that as an alternative, this technology has emerged with high potential, covering the high modern agro-environmental criteria.

The purpose of this study is to justify and determine the influence of mechanical tillage and method of sowing on yield.

In relation to the target is conducted experimental study of tillage and sowing in growing corn.



1 2 3 4

***Fig.3**. Machines applied in the classic technology: 1 – plough; 2 – disk harrow; 3 – cultivator; 4 – classic seed drill*

To conduct the study for the corresponding classical and "Strip-till" technology in growing row crops, the experienced equipment is used as shown in Fig. 3 and Fig. 4.

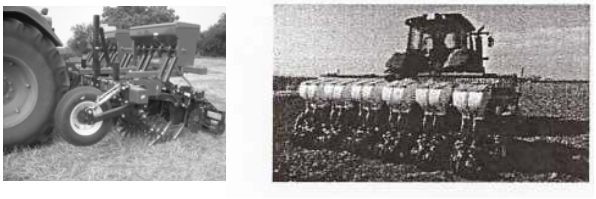


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***Fig.4.** Machines from „Strip-till" technique: 1-strip till subsoiler; 2- twin rows planting machine, [3,4]*

Each technological operation performed by these machines is held in the agricultural period and precisely made adjustments to the machines.

By conducting the dispersion experiment observed the effect of the technology on the yield of corn, which in equal conditions applied will show at what the comparators technology the yields are higher. As control factors in the experiment include: the type of primary soil cultivation (A) and the method of sowing (B). The levels of control factors are consistent with agro-technical requirements for cultivation. Each factor is changed to the following levels: A1 - classical plowing at 0.25 m depth; A2 - strips loosening at 0.25 m depth; B1 - Standard wide row sowing; B2 - chess sowing in twin rows. They were assessed separately with factor A, factor B, and their joint influence. The indicator

Source of distraction	Sum of squares	Degrees of freedom	Rating dispersions	Fisher's Critetion
Factor	SS_A	$k_A = p - 1$	$S_A^2 = \frac{SS_A}{k_A}$	$F_A^2 = \frac{S_A^2}{S_E^2}$
Factor B	SS_B	$k_B = p - 1$	$S_B^2 = \frac{SS_B}{k_B}$	$F_B^2 = \frac{S_B^2}{S_E^2}$
Combined effect on Factor A and factor B	SS_{AB}	$k_{AB} = p - 1$	$S_{AB}^2 = \frac{SS_{AB}}{k_{AB}}$	$F_{AB}^2 = \frac{S_{AB}^2}{S_E^2}$
Casual and non accounted factors	SS_E	$k_E = (p - 1).(p - 1)$	$S_E^2 = \frac{SS_E}{k_E}$	$F_{\alpha,(p-1),kE}$
Summary impact	SS	$\kappa = p^2 - 1$	$S^2 = \frac{SS}{k}$	

(parameter of optimization), which was performed this assessment is grain yield - Y.

The study used the cybernetic approach in which research subject is presented with the "Black box". This approach allows the site to study and manage only by his reactions Yj; j = 1, resulting from the exercise on it externalities called factors - steered (A, B) and unmanaged (w1, w2, ... wq). At fixed values of control factors as a result of the effects of unmanaged factors each of the parameters of the output has a casual nature.

The dispersion analysis express the influence of controllable factors on the parameter by setting separate sums up the basic equation of analysis of variance, which in two factors has the form:

$$SS=SS_A+SS_B+SS_{AB}+SS_E, \quad (1)$$

where: the SSA is the amount that expresses the influence of factor A on the parameter Y;

SSB is the amount that expresses the influence of the factor B, on parameter Y;

SSAB - an amount that expresses the mutual influence of factors A and B on the parameter Y;

SSE - residual sum of squares, which expresses the impact of unmanaged and unaccounted factors on the parameter Y.

To express the amounts characterizing the influence of factors on the parameters is necessary attempts to be hold by a special scheme called "Plan the experiment". The idea of two-factor variance analysis consists in studying the possible reasons for the variation of the parameter Y, which in accordance with the expression (1) may be due to the amendment of any of the selected control factors. In analyzes the factors involved on two levels, which in FFE (full factorial experiment) is associated with carrying too many attempts, and that in the field can be a cause of frustration experiment. Since absent relationship between selected factors and convenience in conducting the trials as experimental plan is approved table shown below. When these factors and their levels, the chosen plan is shown in Table 1 form.

Table 1. Plan the experiment for two-factors dispersion analysis

		Soil tillage (Factor A)	
		A_1	A_2
Planting (Factor B)	B_1	A_1B_1	A_2B_1
	B_2	A_1B_2	A_2B_2

In Table. 1 so the indicated levels of both factors are as follows:

- A1 - plowing
- A2 – stril till
- B1 - classical planting
- B2 – twin rows planting

The study is limited to ascertaining the impact of the selected control factors on the yield of corn. The verification is performed using the Fisher's criteria, calculated as its value for each of the factors is compared with the critical value. The factors for which the computed value of the criterion of Fischer is less than the critical $F_{\alpha,(p-1),kE}$, are considered to be negligible influencing parameter Y.

Conveniently is derived from statistical processing results to be made to the Table of variance analysis (Table 2).

Table 2. Two-way analysis of variance in presence of parallel experiments

Data processing is done by using "Statistica" -10 software product, which significantly reduces the time to analyze the results. The studies were performed in real field conditions, subject to the requirements of the company delivered seed, such as: size of the experimental areas, sowing rates, fertilization rates, etc.

The classical soil preparation includes: primary treatment with mouldboard plow to a depth of 0.25 m; disking to a depth of 0.10 ÷ o.12 m and merged cultivation depth of sowing. Non-traditional soil preparation include strips subsoiling to a depth of 0.25 m in distance between the strips 0.70 m.

Traditional and non-traditional ways of sowing is carried out in wide intelines at the same spacing and observing the same sowing rate - 65000 germinating seeds per hectare. The difference in sowings consists in the fact that in non-traditional sowing rows with plants are paired. In this embodiment the sowing of the crop is staggered in paired rows, whereby plants from the paired lines are out of phase with each other by a distance equal to the required distance Interlinear.

In the experiment, the experimental field is divided in advance into equal size plots, [1]. The number of the plots corresponds to the number of boxes in the plan of the experiment (Table 3), taking into account the double repetition of the experiments. For ease of harvest is well parcels be arranged longitudinally under a scheme as shown in Figure 5.

Figure 5. Prots distribution on the field

Each plot has a 16,8 m width. So in the plot can be planted 24 rows of length equal to the length of the plot-142m.

The subsoiler's traction resistance barcode requires a tractor with a power of 250 ÷ 300 hp, which is enough for Semi-mounted 8-furrow mouldboard plow. Working widths of both tillage implements are respectively 4,2 m and 2,4 m, which in "forehead" of the plot of 16,8 m means cultivating units will perform integer crossings in it. The same goes for sowing aggregates. Movement of shuttle assemblies is such that between the plots shown in Figure 5. Lettering of the plots in Figure 5 corresponds to specified levels of control factors in the experiment.

The reported yield was presented with the average of the duplicate repetitions in partselkite (Table 3) and equated to Moisture 14% (Table 4).

Table 3. Accounted average yield I kg/ha

		Soil tillage (Factor A)			
		Plowing		Strip till	
		1st trial	2nd trials	1st trial	2nd trial
Planting (Factor B)	Classic planting	671	708	887	884
	Twin rows planting	867	937	870	860

Table 4. Croching average yields

		Soil tillage (Factor A)			
		Plowing		Strip till	
		1-ви опит	2-ри опит	1-ви опит	2-ри опит
Planting (Factor B)	Classic planting	667	675	882	879
	Twin rows planting	862	932	865	855

Adduced values of the yields are introduced into a mold of the software "Statistica" -10 (Table 5). Obtained after treatment of the matrix results are presented in a table (Table 6) and graphical (Figure 6, Figure 7 and Figure 8).

Таблица 5. Матрица на експеримента

	1 A	2 B	3 Y
1	a1	b1	667
2	a1	b1	675
3	a2	b1	882
4	a2	b1	879
5	a1	b2	862
6	a1	b2	932
7	a2	b2	865
8	a2	b2	855

Таблица 6. Резултати от дисперсионния анализ

Effect	Univariate Tests of Significance for Y Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	5473086	1	5473086	8630,926	0,000000
A	14878	1	14878	23,462	0,008377
B	21115	1	21115	33,298	0,004477
A*B	30381	1	30381	47,910	0,002286
Error	2537	4	634		

At significance level α = 0,05 shows that the type of soil cultivation and the type of sowing, and the both factors together affect greatly the yield of grain. This follows from the lows of probability p - the kind of cultivation is p = 0,008377; the type of sowing is p = 0,004477, and the joint influence of tillage and sowing is p = 0,002286. All three values are significantly smaller than the level of significance of α = 0,05, as the less is p, the more factors influence the parameter Y. Therefore, the type of drill has a greater influence on the yield of grain on the type of tillage, but the greatest impact on yield has joint interaction of these two factors, [2].

This is evident from the presented graphic relationships. From Figure 6 and Figure 7 it is seen that the level of change of the factor leading to an increase in yield, and for both factors that increase is in their second level. The absence of overlap between confidence intervals at different levels confirms the strong influence of each factor.

Figure 6. Influence of factor A on the grain yield

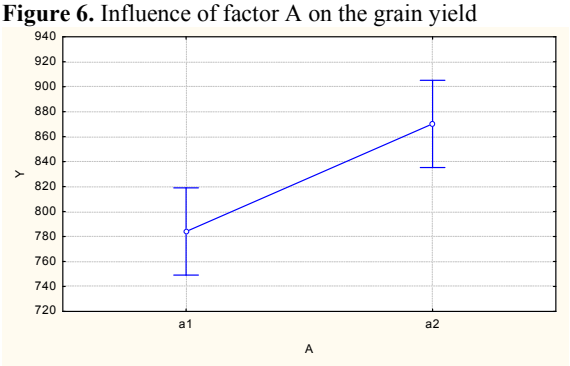


Figure 7. Influence of factor B on the grain yield

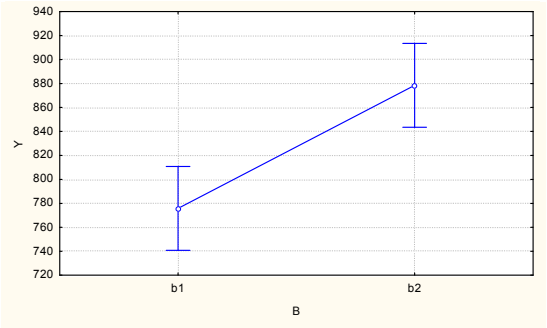
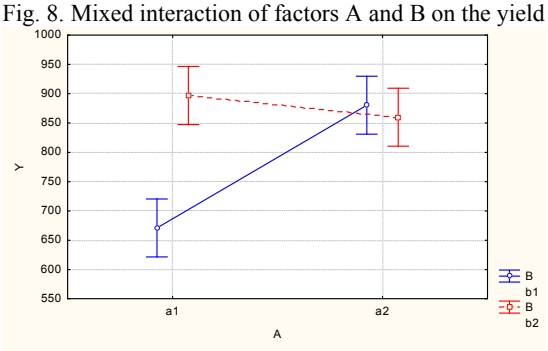


Fig. 8. Mixed interaction of factors A and B on the yield



The most significant experience was conducted on the information they provide graphs of figure 8. The line in blue shows the change in yield in classical sowing and red color - the chess sowing twin rows. At level A1 (classic plowing) the yield can be increased by applying a chess sowing (confidence interval in red is higher located). In the case that apply classical sowing, increased yield can be achieved by applying a ridged tillage (confidence interval sino at level 2 is set higher than that of a1). The yield that is obtained by applying both the ridged tillage and staggered two lines sowing, not statistically different from the said two versions, but as components of a "Strip till" technology, this extraction is combined with a number of other advantages which are not subject to this study but are characteristic of this way of growing row crops, [2].

Conclusion

In conclusion it can be said that the replacement of traditional method of cultivation with "Strip till" technology leads to improved production results, while helping to improve the moisture retention of the soil, breaking plow pan, reduce soil erosion and more. The positive effects that have individual elements of this technology in combination with the classic technology enables farmers to smoothly move from one to the other, gradually replace your existing techniques after full utilization of its resources.

Literature

1. http://login.geoscan.bg/map
2. Software product “Statistica 10”
3. Strip till Machine – Manual for operation.
4. Ägrimaster Seed drill. Manual of operation.