RESEARCHES CONCERNING THE RELATIONSHIP BETWEEN THE TRUNK GROWING AND THE FRUITS PRODUCTIONS, UNDER THE INFLUENCE OF IRRIGATION AND FERTILIZATION WITH NITROGEN

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Key words: growing efficiency of the surface of the trunk section, fruit production.

Abstract. The researches were made on an apple tree plantation, on an experimental field organized within the Lipova’s fruit-growing basin.

The biological used material was the Starkrimson type, grafted on the father plant M9, being planted on bands of two rows at 1.5 m distance between trees from the band and on the row and 3.5 m between bands. Application of irrigation and fertilization with nitrogen determined significant efficiency of the trunk growing. The fertilized variants with 100 kg/ha nitrogen determined significant efficiency of 3.61 cm$^2$ comparing to the fertilized variants of 50 kg/ha nitrogen and non fertilized variants. Irrigation at the level of 75% I.U.A. determined a significant efficiency of 4.82 cm$^2$ of the transversal section of the trunk comparing to the non irrigated variants and those irrigated at the level of 50% I.U.A. determined a distinctly significant efficiency of 2.39 cm$^2$ comparing to the non irrigated witness.

The growing of the trees’ trunk depends in a great measure of the initial measure of the thickness of the trunk. Under the non irrigation conditions the thickness growing of the trunk registered smaller values than under the non irrigation conditions with different norms. Relation between the growing efficiency and initial thickness of the trunk is more dependant as the level of supplying with water is lower.

INTRODUCTION

The apple tree is one of the species which react favorable to irrigation forming a sufficiently big growing and insuring great and quality productions (2). Because in the main areas from the country there are registered extended periods of drought in July and August, when the needs of the apple tree concerning the water are very high it is needed the application of the irrigation. The apple is one of the sensitive species at the nitrogen deficiency in the soil; this is why it is necessary to know its characteristics in order to realize a proper irrigation system (3). Within the fruit orchards the recommended quantities of fertilizers are strongly bound to the planned crop, to the pedoclimate area and to the applied technology (6). The need for water of the trees is different depending on the species, but the
critical phases are during the growing of the copse, after binding and during the intense growing of fruits (5). On the slope land comparing to the plane areas the balance of water and nitrogen is less balanced (4).

MATERIAL AND METHOD

The researches were made on an apple tree plantation, on an experimental field organized within the Lipova’s fruit-growing basin, during 1995-1997. The biological used material was the Starkrimson type, grafted on the father plant M9, being planted on bands of two rows at 1,5 m distance between trees from the band and on the row and 3,5 m between bands. The leading of the top crown of the tree was made under the form of a thin stem. The soil is luvosoil, and the plantation is situated on a versant with a south-west position, having the slope of 0.5-1%. The main properties of the soil and of the water balance in the soil were exposed within a previous work paper.

The experimental factors are: Factor A - irrigation: $a_1$ – non irrigated; $a_2$ – irrigated at the level of 50% I.U.A.; $a_3$ – irrigate at the level of 75% I.U.A.; Factor B – fertilization: $b_1$ – non fertilized; $b_2$ – fertilized with 50 kg/ha s.a. N; $b_3$ – fertilized with 100 kg/ha s.a. N.

The variants were arranged within the plantation after the method of subdivided parcels, with 3 repetitions, by systematic arrangement of the factor A. At the level of factor B, the number of trees was 4.

There were administrated different norms of watering, depending on the established conditions for each variant. In the first year of experience there were administrated 30 t/ha of manure and mixed with the autumn ploughland. Every year were administrated chemical fertilizers as follows: 100kg/ha s.a. N, under the form of nitrogenous of ammonium, after binding the fruits and during the intense growing of copse, 100kg/ha P$_2$O$_5$, under the form of super phosphate and 80 kg/ha K$_2$O, under the form of potassium salt, administrated in the autumn and mixed with the soil.

There were made observations over the thickness growing of the trunk, expressed through the annual growing efficiency of the surface of the transversal section and of the fruit production. The fruit crop was made manually, by the optimum time of cropping. The fruit production was determined through the weighing of the quantity of fruits per tree.

The experimental results were statistically processed through the method of variation, using as a witness the non irrigated and non fertilized variant.

RESULTS AND DISCUSSIONS

Application of irrigation at the limit of 50% I.U.A. and fertilization with 50 kg/ha nitrogen determines a significant growing of the fruit production of 1,34 kg/tree comparing to the non irrigated and fertilized variant with 50 kg/ha nitrogen. Significant growing of the fruit production of 4,80 kg/tree registered in case of application of irrigation at the level of 75% I.U.A. and fertilization with 100 kg/ha nitrogen comparing to the non irrigated and fertilized variants with 100 kg/ha nitrogen.

Relation between the growing of the trunk and fruit production are presented within the table 13.
Table 13. Relationship between trunk growing and the fruit production

<table>
<thead>
<tr>
<th>Specification</th>
<th>Regression equation and correlation coefficient</th>
</tr>
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</table>
| The correlation between the growing efficiency of the trunk section from 1995 and the surface of the initial section from 1995 under the non irrigation conditions. | \[ y = -0.0001x^3 + 0.017x^2 - 0.693x + 14.81 ; \]
| \[ R^2 = 0.286 ; r = 0.534^{***} \] | |
| The correlation between the growing efficiency of the trunk section from 1995 and the surface of the initial section from 1995 under the irrigation at level 50 % I.U.A. conditions. | \[ y = -0.0004x^3 + 0.068x^2 - 3.106x + 53.55 ; \]
| \[ R^2 = 0.281 ; r = 0.530^{***} \] | |
| The correlation between the growing efficiency of the trunk section from 1995 and the surface of the initial section from 1995 under the irrigation at level 75% I.U.A. conditions. | \[ y = -0.0001x^3 - 0.014x^2 + 1.522x + 7.398 ; \]
| \[ R^2 = 0.0738 ; r = 0.271 \] | |
| The correlation between the growing efficiency of the trunk section from 1996 and the fruit production from 1995 under the non irrigation conditions. | \[ y = -0.091x^3 + 1.521x^2 - 7.443x + 15.471 ; \]
| \[ R^2 = 0.171 ; r = 0.414^{**} \] | |
| The correlation between the growing efficiency of the trunk section from 1996 and the fruit production from 1995 under the irrigation at level 50% I.U.A. | \[ y = -0.201x^3 + 4.687x^2 - 35.119x + 91.512 ; \]
| \[ R^2 = 0.208 ; r = 0.456^{**} \] | |
| The correlation between the growing efficiency of the trunk section from 1996 and the fruit production from 1995 under the irrigation at level 75% I.U.A. | \[ y = -0.003x^3 - 0.157x^2 + 2.806x - 5.261 ; \]
| \[ R^2 = 0.132 ; r = 0.363^{**} \] | |
| The correlation between the fruit production from 1995 and surface of the initial section from 1995 under the non irrigation condition. | \[ y = -8E-05x^3 + 0.013x^2 - 0.608x + 13.191 ; \]
<p>| [ R^2 = 0.469 ; r = 0.685^{***} ] | |</p>
<table>
<thead>
<tr>
<th>The correlation between the fruit production from 1995 and surface of the initial section from 1995 under the irrigation at level 50 % I.U.A. condition.</th>
<th>$y = - 5 \times 10^{-5}x^3 + 0.0078x^2 - 0.399x + 13.981$ ; $R^2 = 0.108 ; r = 0.329^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>The correlation between the fruit production from 1995 and surface of the initial section from 1995 under the irrigation at level 75 % I.U.A. condition.</td>
<td>$y = - 0.0002x^3 + 0.0236x^2 - 1.149x + 26.39$ ; $R^2 = 0.0536 ; r = 0.231$</td>
</tr>
<tr>
<td>The correlation between the fruit production from 1995 and the growing efficiency of the trunk section from 1995 under the non condition.</td>
<td>$y = - 0.0009x^3 + 0.0351x^2 - 0.049x + 4.296$ ; $R^2 = 0.476 ; r = 0.690^{**}$</td>
</tr>
<tr>
<td>The correlation between the fruit production from 1995 and the growing efficiency of the trunk section from 1995 under the irrigation at level 50 % I.U.A. condition.</td>
<td>$y = - 0.0026x^3 + 0.101x^2 - 0.987x + 9.596$ ; $R^2 = 0.463 ; r = 0.680^{***}$</td>
</tr>
<tr>
<td>The correlation between the fruit production from 1995 and the growing efficiency of the trunk section from 1995 under the irrigation at level 75 % I.U.A. condition.</td>
<td>$y = - 0.0004x^3 + 0.024x^2 - 0.207x + 7.875$ ; $R^2 = 0.392 ; r = 0.626^{***}$</td>
</tr>
<tr>
<td>The correlation between the fruit production from 1996 and the growing efficiency of the trunk section from 1995 under the non irrigation condition.</td>
<td>$y = - 0.0013x^3 + 0.046x^2 - 0.273x + 10.181$ ; $R^2 = 0.161 ; r = 0.401^{*}$</td>
</tr>
</tbody>
</table>
| The correlation between the fruit production from 1996 and the growing efficiency of the trunk section from 1995 under the irrigation at level 50% I.U.A. condition. | \( y = -0.0002x^3 + 0.019x^2 - 0.196x + 11.917 \);  
\( R^2 = 0.129 \);  
\( r = 0.359 \)  
   |
| The correlation between the fruit production from 1996 and the growing efficiency of the trunk section from 1995 under the irrigation at level 75% I.U.A. condition. | \( y = -7E-05x^3 + 0.043x^2 - 1.207x + 22.858 \);  
\( R^2 = 0.179 \);  
\( r = 0.423 \)  
   |
| The correlation between the fruit production from 1996 and the fruit production from 1995 under the non irrigation condition. | \( y = 0.094x^3 - 1.738x^2 + 10.512x - 10.139 \);  
\( R^2 = 0.122 \);  
\( r = 0.349 \)  
   |
| The correlation between the fruit production from 1996 and the fruit production from 1995 under the irrigation at level 50% I.U.A. condition. | \( y = -0.306x^3 + 6.675x^2 - 46.891x + 117.52 \);  
\( R^2 = 0.187 \);  
\( r = 0.432 \)  
   |
| The correlation between the fruit production from 1996 and the fruit production from 1995 under the irrigation at level 75% I.U.A. condition. | \( y = -0.306x^3 + 7.940x^2 - 66.97x + 198.17 \);  
\( R^2 = 0.137 \);  
\( r = 0.371 \)  
   |
| The correlation between the fruit production from 1997 and the growing efficiency of the trunk section from 1996 under the non irrigation condition. | \( y = 0.040x^3 - 0.721x^2 + 4.384x + 3.980 \);  
\( R^2 = 0.179 \);  
\( r = 0.423 \)  
   |
| The correlation between the fruit production from 1997 and the growing efficiency of the trunk section from 1996 under the irrigation at level 50% I.U.A. condition. | \( y = 0.0337x^3 - 0.802x^2 + 6.001x - 0.258 \);  
\( R^2 = 0.0857 \);  
\( r = 0.292 \)  
   |
The correlation between the fruit production from 1997 and the growing efficiency of the trunk section from 1996 under the irrigation at level 75% I.U.A. condition.

\[ y = 0.0037x^3 - 0.175x^2 + 2.563x + 5.161 ; \]
\[ R^2 = 0.078 ; r = 0.279 \]

The correlation between the fruit production from 1997 and the fruit production from 1996 under the non irrigation condition.

\[ y = 0.0034x^3 - 0.081x^2 + 0.631x + 11.262 ; \]
\[ R^2 = 0.033 ; r = 0.182 \]

The correlation between the fruit production from 1997 and the fruit production from 1996 under the irrigation at level 50 % I.U.A. condition.

\[ y = 0.0137x^3 - 0.587x^2 + 8.331x - 24.865 ; \]
\[ R^2 = 0.125 ; r = 0.353 \]

The correlation between the fruit production from 1997 and the fruit production from 1996 under the irrigation at level 75 % I.U.A. condition.

\[ y = 0.0112x^3 - 0.456x^2 + 5.777x - 5.748 ; \]
\[ R^2 = 0.298 ; r = 0.545^{***} \]

The growing of the trees’ trunk depends in a great measure of the initial measure of the thickness of the trunk. Under the non irrigation conditions the thickness growing of the trunk registered smaller values than under the non irrigation conditions with different norms. Relation between the growing efficiency and initial thickness of the trunk is more dependant as the level of supplying with water is lower. In the case when there was not irrigated the dependence of the growing efficiency of the trunk, it was significant of 28.59% comparing to the initial section of the trunk section, correlation coefficient \( r=0.534^{***} \). There were established the relations between the surface efficiency of the trunk section from the year 1996 and the fruit production from the year 1995. Under the conditions of supplying the soil with water only from rain, the surface efficiency of the section had smaller growing than in case of application of irrigation. Under non irrigated conditions, the dependence of the growing efficiency of the trunk section comparing to the production is of 17.15% being statistically insured. When the stock of water from the soil mentioned at the level of 50 and 75% I.U.A. the dependence was distinctly significant of 20.81% respectively 13.21%.

Between the production from 1995 and the initial section of the trunk was a significant dependence of 46.98% under the non irrigation conditions. Under the conditions when the irrigation was applied, the fruit production dependence from 1996 comparing to the one from 1995 is significant and the determination coefficient of 12.24%, is significant.

Under the non irrigation conditions, the fruit production dependence in 1997 comparing to the surface efficiency of the trunk section from 1997 is distinctly significant of 17.93%. In case of irrigation at the levels of 50 and 75% I.U.A. the fruit production dependence from
1997 comparing to the one from 1996 was significant of 12.47%, respectively very significant of 29.80%.

CONCLUSIONS

Application of irrigation and fertilization with nitrogen determined significant efficiency of the trunk growing. The fertilized variants with 100 kg/ha nitrogen determined significant efficiency of 3.61 cm² comparing to the fertilized variants of 50 kg/ha nitrogen and non fertilized variants. Irrigation at the level of 75% I.U.A. determined a significant efficiency of 4.82 cm² of the transversal section of the trunk comparing to the non irrigated variants and those irrigated at the level of 50% I.U.A. determined a distinctly significant efficiency of 2.39 cm² comparing to the non irrigated witness.

The doses of 50 and 100 kg/ha nitrogen determined production efficiencies distinctly and significant of 1.47 and 3.57 kg/tree comparing to the non irrigated variants. Irrigation at the levels of 50 and 75% I.U.A. determined fruit production efficiency distinct and significant of 1.47 and 3.57 kg/tree comparing to the non-irrigated variants.

BIBLIOGRAPHY