SUMMARY OF PHD THESIS

RESEARCH ON THE INFLUENCE OF SOME TECHNOLOGY ELEMENTS ON THE LEVEL AND QUALITY PRODUCTION AT THE IRRIGATED SOYBEAN CROP, IN THE TURDA AREA CONDITIONS

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CHAPTER I - GENERAL ASPECTS OF SOYBEAN CROP

The first particulars of soybeans are in "Pen Ts'ao Kong Mu" which dates from 2838 BC and was written by Chinese emperor Sheng-Hung (MORSE, 1950, quoted by GIOSAN et al., 1986). There is evidence that in our country soybean crop was introduced to the late nineteenth century, being reported since 1876, in some gardens as an ornamental plant (in Transylvania). Given the growing culture in the Transylvanian Plain, here are cultivated with priority soybean varieties developed at the Research and Development Station Turda (VALUŢĂ, 1943; DENCESCU şi POPA, 1982; GIOSAN şi colab., 1986; MUREŞANU, 2003).

CHAPTER II - CURRENT STATE OF RESEARCH REGARDING THE CULTURE TECHNOLOGY IN SOYBEAN

Soybean, compared to other cultures, is considered less demanding in rotation and rotation length (ROBINSON, 1966; BEATLY and ELDRINGE, 1979; GIOSAN, NICOLAE, SIN, 1986). Extensive research on the soy crop technology were developed to ICCPT Fundulea and SCDA Turda, but also to other research stations in the country (DENCESCU et al., 1982; MURESANU et al., 1982, 1999). Results obtained at Fundulea chernozems in non-irrigated crop and at Valu lui Traian under irrigation conditions highlights the wheat crop very good as a preceding culture to soybean, lower production being obtained after beet and soybean (DENCESCU et al., 1982; GIOSAN, NICOLAE, SIN, 1986). Ground work has to be performed taking into account the soil type, microclimate area, cropping patterns, and to apply a differentiated agrotechnics (GUS, RUSU, ILEANA BOGDAN, 2003 MUNTEAN et al., 2001, 2008). Soybean sowing must take place before or concurrent with that of corn, so as to be completed on the 20th of April in the south and on the 30th of April in other areas (GIOSAN, NICOLAE, SIN, 1986, SALONTAI, 1991; BORCEAN et al., 2003, 2004, GUS et al., 2003; MUNTEAN et al., 2001, 2008).
CHAPTER III - CURRENT STATE OF RESEARCH REGARDING THE IRRIGATION REGIME AND SOY WATER CONSUMPTION

Knowledge of crop water consumption is of particular importance in irrigated agriculture, as irrigation is used to calculate rules in forecasting and warning splashing (ONU, 1988; NAGY, 1994; PLEȘA și CÎMPEAN, 2001; SILVICA ONCIA, 2004; LUCA, BUDIU, ANA CIOTLĂUȘ, 2008). For the development and fruiting of soy is necessary that during July-August to maintain minimum threshold of at least 50% of IUA on the depth of 60-80 cm.

CHAPTER IV - CHARACTERIZATION OF THE NATURAL AREA OF VIȘOARA - TURDA, WHERE THE RESEARCH HAD BEEN CONDUCTED

Experimental field was located in the unincorporated village Vișoara, Cluj County, on the left bank of the river Aries, near Câmpia-Turzii town (about 2 km from it), and the european road E60. Overall, 2009 was a warm year, monthly average was 1,3\(^\circ\)C above average multiannual and in terms of rainfall, the year 2009 is characterized as very dry, but the whole dry periods are alternating very dry and excessively dry with periods of rainy, very rainy and excessively rainy. The year 2010 was characterized as a warm one, with a monthly annual average of de 9,7\(^\circ\)C, superior with 0,8\(^\circ\)C to the multiannual average. 2010 was an excessively rainy year. 2011, as a whole, can be characterized as a normal year. In terms of rainfall, the year 2011 is characterized as very dry, but the whole normal periods are alternating with the dry and the rainy ones.


The PhD thesis "Research on the influence of some technology elements on the level and quality production at the irrigated soybean crop, in the Turda area conditions"
was developed following the research conducted in 2009-2011, with the primary goal to determine the degree of influence of the irrigation regime and other elements of technology, on the level of production and its quality, at three soybean varieties developed at Agricultural Research and Development Station Turda. Experimental factors studied in experiments conducted during 2009 - 2011 in the Viișoara - Turda area and their graduations, are presented in Table 5.1.

Soybean crop technology was applied as recommended by the research team of the Research Station - Development Turda. For basic fertilization were administered every year 60 kg / ha N, 30 kg / ha P2O5 and 30 kg / ha K2O and the additional fertilization was done on the seeds with Nitragin to stimulate the formation of the nitrogen fixing nodules on the roots. Organic fertilization was achieved by applying 40 tons of manure on the prior corn crop in a rotation ready for environmental certification of three cultures, namely wheat, corn and soybeans.

Table 5.1.

Summary of the experimental factors

<table>
<thead>
<tr>
<th>Factorii studiați / Analyzed factors</th>
<th>Graduări / Graduations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factorul A: Regimul de irigare / Irrigation regime</td>
<td>a₁ – neirigat / non-irrigated</td>
</tr>
<tr>
<td></td>
<td>a₂ – irigat la 50 % din intervalul umidității active (IUA)/ irrigated</td>
</tr>
<tr>
<td>Factorul B: Fertilizare / Fertilisation</td>
<td>b₁ – fertilizare de bază</td>
</tr>
<tr>
<td></td>
<td>b₂ – fertilizare de bază + fertilizare suplimentară</td>
</tr>
<tr>
<td></td>
<td>b₃ – fertilizare organică</td>
</tr>
<tr>
<td>Factorul C: Material biologic (Soi): Variety</td>
<td>c₁ – Onix</td>
</tr>
<tr>
<td></td>
<td>c₂ – Eugen</td>
</tr>
<tr>
<td></td>
<td>c₃ – Felix</td>
</tr>
</tbody>
</table>

Quality analysis were performed at the Institute for Research and Analytical Instrumentation (ICIA) Cluj-Napoca. Besides the accustomed analysis, the protein content of soybean samples belonging to the variations experienced during 2009 - 2011 at
Viişoara - Turda was also determined the main metal, amino acids, vitamins and lecithin content.

CHAPTER VI - RESULTS OF THE RESEARCH REGARDING THE INFLUENCE OF THE IRRIGATION, FERTILIZATION AND BIOLOGICAL MATERIAL REGIME ON THE SOYBEAN PRODUCTION IN THE CONDITIONS OF TRANSYLVANIAN PLAIN

Analysis of the effect the first of the three factors studied, irrigation regime on grain production in soybean crop in the conditions of Viişoara - Turda, during 2009 - 2011, showed higher yields on irrigated variants, than the non-irrigated variants, in each of the three years. Registered production growth due to irrigation was 704.70 kg / ha (27.5%), highly statistically significant difference (p 0.1% = 620.20).

Table 6.28.

<table>
<thead>
<tr>
<th>Variant</th>
<th>Average yield (kg/ha)</th>
<th>Relative yield (%)</th>
<th>Difference ± d (kg/ha)</th>
<th>Significance of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>a₁ - neirigat</td>
<td>2565,15</td>
<td>100,0</td>
<td>0,00</td>
<td>Mt</td>
</tr>
<tr>
<td>a₂ – irigat la 50 % IUA</td>
<td>3269,85</td>
<td>127,5</td>
<td>704,70</td>
<td>***</td>
</tr>
</tbody>
</table>

Fertilization factor influenced, every year, the production of grains, the best results being registered by the variant where additional fertilized was added on the base treatment. Output gap compared to the control, b₂ registered version, which had additional fertilizer was highly significant, 158.43 kg / ha, respectively 5.5%. B₃ version, on which the organic fertilization was added, showed 96.4% of the control, the difference compared to the control, of 104.15 kg / ha, being very significant negative (Table 6.29.).
Table 6.29.


<table>
<thead>
<tr>
<th>Variant</th>
<th>Average yield (kg/ha)</th>
<th>Relative yield (%)</th>
<th>Difference ± d (kg/ha)</th>
<th>Significance of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>b₁</td>
<td>2899,41</td>
<td>100,00</td>
<td>0,00</td>
<td>Mt,</td>
</tr>
<tr>
<td>b₂</td>
<td>3057,83</td>
<td>105,5</td>
<td>158,43</td>
<td>***</td>
</tr>
<tr>
<td>b₃</td>
<td>2795,26</td>
<td>96,4</td>
<td>-104,15</td>
<td>000</td>
</tr>
</tbody>
</table>

LSL (p 5%)                 37,62  
LSL (p 1%)                 54,72  
LSL (p 0,1%)              82,08

The influence of the C factor – biological material (variety) on the production of soybean, was noticed that the average production of the control variant, variety Onix, during 2009 - 2011 was exceeded by the Eugen variety and Felix variety, with 158.83 kg / ha (5.7%) and with 283.28 kg / ha (10.2%), statistically very significant (p 0.1% = 59.29) (Table 6.30.).

Table 6.30.

Influence of C factor - biological material (cultivated variety) on the production of soy beans, Vișițoara - Turda, 2009 - 2011

<table>
<thead>
<tr>
<th>Variant</th>
<th>Medium yield (kg/ha)</th>
<th>Relative yield (%)</th>
<th>Difference ± d (kg/ha)</th>
<th>Significance of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>c₁ .Onix</td>
<td>2770,13</td>
<td>100,00</td>
<td>0,00</td>
<td>Mt,</td>
</tr>
<tr>
<td>c₂ .Eugen</td>
<td>2928,96</td>
<td>105,7</td>
<td>158,83</td>
<td>***</td>
</tr>
<tr>
<td>c₃ .Felix</td>
<td>3053,41</td>
<td>110,2</td>
<td>283,28</td>
<td>***</td>
</tr>
</tbody>
</table>

LSL (p 5%)                 32,57  
LSL (p 1%)                 44,27  
LSL (p 0,1%)              59,29

In each of the years 2009, 2010 and 2011, in which the experiences from Vișițoara – Turda where organized, analyzing influence of the interaction of three factors the irrigation regime, fertilization and biological material on the level of production of soy beans, showed gains obtained in all by combinations, in which graduation a₂ – irrigated
was part, compared to the combination of which was part of graduation a1 – non-irrigate d.

Fig. 6.7. Influence of the interaction of experimental factors A X B X C - irrigation regime x fertilizer x biological material (cultivated variety) on the production of soy beans in terms of Vişoara - Turda, 2009 - 2011

The highest levels were recorded by the variants a2b2c3 – irrigation x basic fertilization + additional fertilization x Felix - 3593.33 kg / ha, a2b1c3 – irrigation x basic fertilization x Felix - 3419.00 kg / ha and a2b2c2 - irrigation x basic fertilization + additional fertilization x Eugen - 3405.78 kg / ha.


During the experimental research of this PhD thesis was aimed the interaction influence of the experimental factors A- irrigation regime, and B – fertilization, applied during the time of culture vegetation on the quality of soybeans in the conditions of Vişoara - Turda, during the studied period. It is noted that the results presented refer to the average production for 2009-2011. Thus, measurements were made to establish the content of the grains in lecithin, in vitamins (C, B6 and B9), the main amino acids (LSL Alanine, LSL Tyrosine, LSL histidine, glutamic acid, LSL phenylalanine, aspartic acid
and glycine) and metals - sodium (Na), magnesium (Mg), calcium (Ca), manganese (Mn), iron (Fe), copper (Cu) and zinc (Zn). Figures 7.1. - 7.10. present values quality determinations at soybeans, belonging to the three varieties grown under irrigation and non-irrigation conditions, and under different fertilization conditions.

Fig. 7.1. Lecithin content (%) (a) and vitamin C (b) of soybean, the average production of the years 2009-2011, achieved in the conditions of Viişoara – Turda

Fig. 7.5. Content of LSL Alanine (a), LSL Tyrosine (b), LSL Histidine (c), Glutamic acid (d), LSL Phenylalanine (e) and Glycine (f) content in soybeans, the average of the years 2009-2011, realised in the conditions of Viişoara – Turda

The evolution of water consumption, at irrigated and non-irrigated soybean crops, between 2009 and 2011, in the conditions of Viişoara – Turda, is presented in fig. 8.4. Total water consumption recorded during the growing season, under non-irrigation, in 2009, was 3871 m$^3$/ha, in 2010, 4325 m$^3$/ha and 3745 m$^3$/ha in 2011. In terms of irrigation water consumption was 4699 m$^3$/ha in 2009, 4659 m$^3$/ha in 2010 and 4654 m$^3$/ha in 2011.

Figure 9.1. presents an overview of the changes implemented in irrigation profit, realized by all variants of soybean in the conditions of Vișoara - Turda.
The highest profit was obtained in 2011, which was a good year for soybean and the yields achieved good market price (higher than in 2009 and 2010). According to the results obtained for all three varieties studied, irrigation costs are covered by additional revenues realized by applying irrigation during the growing season.

CHAPTER X – GENERAL CONCLUSIONS

After conducting the research regarding the influence of irrigation regime, fertilization and biological material on the soy crop production in the conditions of the Transylvanian Plain, research conducted during 2009 - 2011 in an experimental field in Vișoara-Turda, Cluj county, field representative conditions of the Transylvanian Plain, the following conclusions can be drawn:

Average production for the entire period, 2009 – 2011, the irrigated variants reached the level of 3269.85 kg / ha and the non-irrigated variants, 2565.15 kg/ha. Registered production growth due to irrigation, the interval 2009 - 2011, was 704.70 kg / ha (27.5%), highly statistically significant difference.

Irrigation and fertilization applied on the soybean culture greatly influenced the content of lecithin, vitamins and metals in grains, during the period of research, 2009-2011. Best reaction at the two factors had variety Felix, and then, variety Eugen.

Total water consumption recorded during the growing season, under non-irrigation, in 2009, was 3871 m³/ha, in 2010, 4325 m³/ha and 3745 m³/ha in 2011. In terms of irrigation water consumption was 4699 m³/ha in 2009, 4659 m³/ha in 2010 and 4654 m³/ha in 2011.

Average daily consumption of vegetation period fluctuated between 15.9 and 35.3 m³/ha/day in 2009, between 16.3 and 33.3 m³/ha/day m³/ha/day in 2010 and between 15.1 and 35.4 m³/ha/day m³/ha/day 2011. Highest daily average water consumption was recorded during the month of July in each of the three years of experimentation.

Analyzing the results obtained in the three years of study, 2009-2011, is showed that the highest profit was achieved in 2011, soybean crop year for both the recorded productions and by good market price (higher compared the years 2009 and 2010).
According to the results obtained for all three varieties studied, irrigation costs are covered by additional revenues realized by applying irrigation during the growing season.

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