

RESEARCH REGARDING THE DETERMINATION OF WATER CONSUMPTION OF SOYBEAN CROP IN THE CONDITIONS OF TRANSYLVANIA PLAIN

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Abstract. *This paper presents some research results on water consumption soybean crop and the influence of technological factors on production of this crop, in the specific conditions of Transylvania Plain. The research was conducted during 2009 - 2011, in an experimental field in Vișoara-Turda. Biological material tested was represented by three varieties of soybeans recently created at the Agricultural Development Research Station Turda, Cluj county.*

Keywords: water consumption, soybean, irrigation regime

INTRODUCTION

The evolution of human society has generated, especially in the last decades, many of the most diverse problems. One of the most important of these problems is the food. The explosive growth of world population is also necessary a growth of the alimentation efficiency and of the crop production that is obtained from a super-intensive agriculture (Nagy, 1982, Luca et collab., 2008).

Soy is one of the plants that has a wide range of use, that can provide solutions for future food and energy evolution of the planet. Soy ranks first position in grain legumes because of its high content in protein, fat, lecithin, vitamins and enzymes. It is very hard to find another plant that within such a short growing season, is able to synthesize the same large amount of valuable substances (Dencescu et collab., 1982; Giosan et collab., 1986; Muresanu et collab., 1999).

In the context of an increasingly generalized seizures of oil, through reducing reserves of conventional fuels, while increasing fuel demand on the world market and with a sharp rise of its price, are more persistent research that are aiming the identifying of non-conventional energy sources, where biodiesel and combined oils (having in their composition vegetal oils in addition to mineral oils), have an increasingly important role (Chintoanu, 2011 Felicia Boar, 2011).

In addition to the many uses in energy, food and livestock industry, soy has curative therapeutic effects, and especially preventive, having an important positive influence on the human body.

MATERIAL AND METHOD

Given the importance of soy culture and perspectives that this culture may have, in conditions of Transylvania Plain, we started, with the teams from Land Improvement and Irrigation discipline, of the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, a series of experiences that bring new technological solutions for this area, at the soybean crop.

In the experiences held in an experimental field of SC NORA LY AGROSERV SRL, at Viișoara – Turda, Cluj County, between 2009 - 2011, three factors were studied: irrigation system, agrofond and biological material, three varieties created at the Agricultural Research and Development Station Turda.

An important direction of research was the determination of water consumption for growing soybeans under irrigation and non-irrigation conditions, such research being conducted for the first time for the soybean crop in Turda area.

In the three years of research and experimentation, three soybean varieties were studied, widespread in the subhumid culture of Transylvania: Onix, Felix and Eugen, varieties that have been created at Agricultural Research and Development Station Turda.

Determination of soil water was done by a direct method, the soil water balance (hydrologic balance).

In conducting the soil water balance were accounted, on one hand, the water entries from the reserve found in the soil, from precipitation and irrigations, throughout the growing season, and on the other hand were summed water exits through the consumption of the culture, plus the final reserve of water left in soil after crop harvest.

RESULTS AND DISCUSSION

To determine water consumption at the soybean crop, in the experiments performed at Viișoara-Turda, soil water balance was prepared, for each year, in 2009-2011, both for the non-irrigated culture and for the irrigated one.

In Table 1 is synthesized the soil water balance in non-irrigation conditions at the soybean crop and in Table 2, under irrigation conditions, in the year 2009, during the growing season.

Total water consumption recorded during the growing season, under non-irrigation conditions, in 2009, was of 3871 m³/ha and under irrigation conditions was of 4699 m³/ha. Average daily consumption in the vegetation period varied between 15.9 m³/ha/day and 35.3 m³/ha/day. The highest average daily water consumption was recorded in July.

As a result of soil moisture deficit at the beginning and end of vegetation period, in May and August were applied two waterings, with norms of 600 and 400 m³/ha.

Table 1
Water consumption determined with soil water balance method, under non-irrigation conditions (Viișoara, 2009)

Time			Entry of water during the growing season				Water outputs		Daily medium consumption m ³ /ha
From	To	Nr. days	Initial reserve (Ri) m ³ /ha	Water from precipitation (P) m ³ /ha	Watering norm (m) m ³ /ha	Total input of water m ³ /ha	Final water reserve (Rf) m ³ /ha	Total water consumption m ³ /ha	
1.IV	30.IV	30	4740	84	-	4824	4348	476	15,9
1.V	31.V	31	4348	314	-	4662	4082	580	18,7
1.VI	30.VI	30	4082	1134	-	5216	4530	686	22,8
1.VII	31.VII	31	4530	525	-	5055	4153	902	29,1
1.VIII	31.VIII	31	4153	381	-	4534	3820	714	23,0
1.IX	15.IX	25	3820	32	-	3852	3429	423	16,9
	Total							3781	

Table 2.

Water consumption determined with soil water balance method, under irrigation conditions
(Viișoara, 2009)

Time			Entry of water during the growing season				Water outputs		Daily medium consumption m ³ /ha
From	To	Nr. days	Initial reserve (Ri) m ³ /ha	Water from precipitation(P) m ³ /ha	Watering norm (m) m ³ /ha	Total input of water m ³ /ha	Final water reserve (Rf) m ³ /ha	Total water consumption m ³ /ha	
1.IV	30.IV	30	4740	84	-	4824	4348	476	15,9
1.V	31.V	31	4348	314	600	5262	4554	708	22,8
1.VI	30.VI	30	4554	1134	-	5688	4808	880	29,3
1.VII	31.VII	31	4808	525	-	5333	4239	1094	35,3
1.VIII	31.VIII	31	4239	381	400	5020	4064	956	30,8
1.IX	15.IX	25	4064	32	-	4096	3511	585	23,4
	Total							4699	-

In Tables 3 and 4 are presented the values of water consumption at the soybean crop, irrigated and non-irrigated, from the vegetation period, in conditions of Viișoara - Turda.

Table 3.

Water consumption determined with soil water balance method, under non-irrigation conditions
(Viișoara, 2010)

Time			Entry of water during the growing season				Water outputs		Daily medium consumption m ³ /ha
From	To	Nr. days	Initial reserve (Ri) m ³ /ha	Water from precipitation (P) m ³ /ha	Watering norm (m) m ³ /ha	Total input of water m ³ /ha	Final water reserve (Rf) m ³ /ha	Total water consumption m ³ /ha	
1.IV	30.IV	30	3816	520	-	4336	3848	488	16,3
1.V	31.V	31	3848	876	-	4724	4084	640	20,6
1.VI	30.VI	30	4084	1726	-	5810	5058	752	25,1
1.VII	31.VII	31	5058	1210	-	6268	5249	1019	32,8
1.VIII	31.VIII	31	5249	492	-	5741	4835	906	29,2
1.IX	15.IX	25	4835	462	-	5297	4777	520	20,8
	Total							4325	-

Total water consumption recorded by the method of soil water balance under conditions of non-irrigation, in 2010, was of 4325 m³/ha and under irrigation conditions was of 4659 m³/ha. Average daily consumption in the vegetation period varied between 16.3 m³/ha/day and 33.3 m³/ha/day. The highest average daily water consumption was recorded in July.

Because the growing season months of 2010 were rich in precipitation, except for the beginning of this period, irrigation was applied only in April, with a norm of 400 m³/ha.

Table 4.

Water consumption determined with soil water balance method, under irrigation conditions
(Viișoara, 2010)

Time			Entry of water during the growing season				Water outputs		Daily medium consumption m ³ /ha
From	To	Nr. days	Initial reserve (Ri) m ³ /ha	Water from precipitation (P) m ³ /ha	Watering norm (m) m ³ /ha	Total input of water m ³ /ha	Final water reserve (Rf) m ³ /ha	Total water consumption m ³ /ha	
1.IV	30.IV	30	3816	520	400	4736	4116	620	20,6
1.V	31.V	31	4116	876	-	4992	4237	755	24,3
1.VI	30.VI	30	4237	1726	-	5963	5157	806	26,8
1.VII	31.VII	31	5157	1210	-	6367	5334	1033	33,3
1.VIII	31.VIII	31	5334	492	-	5826	4915	911	29,4
1.IX	15.IX	25	4915	462	-	5377	4843	534	21,4
	Total				-			4659	-

Tables 5 and 6 show the water consumption at soybean crop, irrigated and non-irrigated, in the vegetation period, in conditions of Viișoara - Turda.

Table 5.

Water consumption determined with soil water balance method, under non-irrigation conditions
(Viișoara, 2011)

Time			Entry of water during the growing season				Water outputs		Daily medium consumption m ³ /ha
From	To	Nr. days	Initial reserve (Ri) m ³ /ha	Water from precipitation (P) m ³ /ha	Watering norm (m) m ³ /ha	Total input of water m ³ /ha	Final water reserve (Rf) m ³ /ha	Total water consumption m ³ /ha	
1.IV	30.IV	30	3810	226	-	4036	3584	452	15,1
1.V	31.V	31	3584	414	-	3998	3478	520	16,8
1.VI	30.VI	30	3478	1168	-	4646	3976	670	22,3
1.VII	31.VII	31	3976	1304	-	5280	4394	886	28,6
1.VIII	31.VIII	31	4394	128	-	4522	3758	764	24,6
1.IX	15.IX	25	3758	228	-	3986	3533	453	18,1
	Total							3745	-

In the vegetation period of 2011, at the soybean crop was registered, under non-irrigation conditions, a water consumption of 3745 m³/ha and a water consumption of 4654 m³/ha under irrigation conditions. Average daily consumption in the vegetation period varied between 15.1 m³/ha/day and 35.4 m³/ha/day. The highest average daily water consumption was as well registered in July.

To complete the plant water requirement, due to mild deficits manifested in May and August, have been applied two waterings, with norms of 600 and 400 m³/ha.

Table 6.

Water consumption determined with soil water balance method, under irrigation conditions
(Viișoara, 2011)

Time			Entry of water during the growing season				Water outputs		Daily medium consumption m ³ /ha
From	To	Nr. days	Initial reserve (Ri) m ³ /ha	Water from precipitation (P) m ³ /ha	Watering norm (m) m ³ /ha	Total input of water m ³ /ha	Final water reserve (Rf) m ³ /ha	Total water consumption m ³ /ha	
1.IV	30.IV	30	3810	226	-	4036	3584	452	15,1
1.V	31.V	31	3584	414	600	4598	3862	665	21,4
1.VI	30.VI	30	3933	1168	-	5101	4248	853	28,4
1.VII	31.VII	31	4248	1304	-	5552	4454	1098	35,4
1.VIII	31.VIII	31	4454	128	400	4982	4028	954	30,7
1.IX	15.IX	25	4028	228	-	4256	3624	632	25,3
	Total				-			4654	-

In each of the three years of experimentation, most of the water requirement has been provided by precipitation, but an important role had the water from soil reserves at the beginning of vegetation period (initial reserve), as well as the water administered through irrigation.

CONCLUSIONS

The experiences organized in specific conditions of Transylvania Plain, at Viișoara - Turda, where the water consumption was determined at the irrigated and the non-irrigated crop soybean, highlighted the useful aspects regarding this cultures' technology addition with new elements, related to completion of necessary water, when needed, during the growing season.

It was found that in this area, rainfall periods alternated with dry or very dry ones. In situations where there has been a lack of moisture in the soil, irrigation was a technological solution favorable for recording significant production increases.

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

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

In each of the three years of experimentation, most of the water requirement has been provided by precipitation, but an important role had the water from soil reserves at the beginning of vegetation period (initial reserve), as well as the water administered through irrigation.

All results obtained are arguments for promoting irrigation at soybean culture in conditions of Transylvania Plain, based on a correctly chosen culture technology and a strictly respected irrigation forecast.

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