The Influence of Tillage and Water Suply on the Soy Production

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ABSTRACT

The choice of soil tillage systems adapted to the pedo-climatic conditions and crop requirements so that the yield and economic efficiency should be attractive for farmers, as well as the modernization of agricultural machinery and implements suitable for this system are expected to expand in the future and to contribute thus to the sustainable development of agriculture, to the improvement of soil fertility and environmental protection. The promotion of conservation agriculture system in versions adapted to the soil conditions with mid-heavy texture and to the requirements of the main crops in the south of Romania which should provide competitive productions, both quantitatively and qualitatively, with reduced costs and high profit. The research has been carried out at the Valul lui Traian Station for Agricultutral Research and Development. The experiments were placed according to the method of subdivided plots, in three repetitions, with tillage systems, towards water conservation and economical optimization of the agricultural management and consisted of the following versions: the level of water supply (three graduations); deep loosening of the soil (two graduations); basic tillage (three graduations). Soy reacts well to irrigations, the yield being very significant and ensured statistically. By analyzing the production data obtained as an effect of the interaction between the three factors and given the no irrigation/no chisel plow/ vibromix version, all the versions cultivated in conditions of water supply/chisel plow and no chisel plow have statistically ensured production growth that is significant, distinctly significant and very significant. Soy uses well the water administered in norms of 50% of the AHI, obtaining higher yields even than those obtained in conditions of irrigation with 100% of the AHI.

Keywords: *chisel plow, water, soy, tillage*.

INTRODUCTION

The choice of soil tillage systems adapted to the pedo-climatic conditions and crop requirements so that the yield and economic efficiency should be attractive for farmers, as well as the modernization of agricultural machinery and implements suitable for this system are expected to expand in the future and to contribute thus to the sustainable development of agriculture, to the improvement of soil fertility and environmental protection.

MATERIALS AND METHODS

The soil in the location perimeter of the experimental lot is vermic chernozem, formed on loess deposits, with medium texture, namely loamy to loamy-earthen, with a clay content between 28 and 32%, distributed homogenously in the soil profile. The soil is light and very light (the degree of subsidence being under 0%), emphasizing a high risk for degradation by excessive loosening

on short-term and a high risk for secondary depth compaction on long-term.

The soil permeability to water is high(the numeric values of the hydraulic conductivity being over 20-30 $mm.h^{-1}$). In the area, groundwater is usually deeper than 10 m. Consequently the natural drainage is good and the risk of excess humidity (at the surface or at depth) is highly reduced.

The structural hydrostability of the soil is reduced, the content of water-stable structural macroaggregates is under 4-8%, emphasizing thus a high risk of soil degradation by destructuration, especially in the intensely irrigated areas, and particularly at the surface.

The soil supply with nutritive elements is moderate. Thus, in the first 10 and 20 cm, respectively, the humus content was between 3.59 and 3.02%; the content of mobile phosphorus was between 60 and 40 $mg.kg^{-1}$, total nitrogen was between 0.23 and 0.20%, and potassium was between 180 and 170 $mg.kg^{-1}$.

The soil reaction was poor to moderately alkaline, the pH (determined in water) being 8.00-8.02.

The experiments were placed according to the method of subdivided plots, in three repetitions on the field, with tillage systems adapted to the local conditions, oriented towards the protection of the agrophysical state of the soil, towards water conservation and economical optimization of the agricultural management and consisted of the following versions:

A. The level of water supply

A1 – full-time irrigation (1m) on 0-90 cm;
A2 – half-time irrigation (1/2m) on 0-90 cm;
A3 – not irrigated.

B. Deep loosening of the soil

B1 – by chisel plow (work executed at the beginning of the experiments);
B2 – no chisel plow work.

C. Basic tillage

C1 – plowing with moldboard plow 20 – 22 cm;
C2 – plowing with chisel plow 18-20 cm;
C3 – tillage with disk plow 13 – 15 cm;

The plants cultivated every year by rotation were: maize, soy and wheat.

Fertilization and other specific works for plant protection during the vegetation period, and pest and disease control were applied uniformly for all versions.

In the irrigated plots, one to three waterings were applied uniformly, according to the plant requirements, but also to the technical and economical possibilities.

Observations were accomplished of the evolution of the vegetative phenophases.

The average yield per ha was determined and the productivity elements were analyzed.

Soil samples were collected in order to establish soil humidity.

Also, soil samples were collected in order to establish the effect of tillage on certain physical and chemical soil indicators. Measurements were done regarding the fuel consumption.

RESULTS AND DISCUSSION

Soy can be cultivated in our country only in conditions of excellent water supply (Alexandru I. Cociu et al, 2011).

By analyzing the production obtained as an effect of each of the studied factors taken separately, we observed the following:

Soy reacts well to irrigations, the yield being very significant and ensured statistically (Tab.1).

The influence of the chisel plow work is poor, the difference between versions being 133 kg/ha (Tab. 2).

The influence of tillage is poor, the difference in production between the plowed version and the other two being -178 kg/ha in the chisel and -125 kg/ha in the vibromix (Tab. 3).At the interaction

Tab. 1. The soy production obtained as an effect of various water supply regimen, Valul lui Traian, 2008-2010.

Crt .nr.	The variant	Production		Difference	Semnficant
		Kg/ha	%	Kg/ha	
1	100%	2566	132	631	***
2	50%	2961	153	1026	***
3	0%	1935	100	Mt	

DL 5% 4,64 kg/ha DL1% 7,68 kg/ha DL 0,1% 14,27 kg/ha

between water supply and chisel plow work, the following versions are distinguished: irrigated 50%/chisel plow work and irrigated 50%/no chisel plow work, the differences in production being statistically ensured and very significant (Tab.4)

At the interaction between the water supply levels and tillage, all the tillage versions on water supply at 50% of the active humidity interval (AHI) (Tab.5) are statistically backed and very significant.

By analyzing the production data obtained as an effect of the interaction between the three factors presented in Table 6. and given the no irrigation/no chisel plow/vibromix version, all the versions cultivated in conditions of water supply/ chisel plow and no chisel plow have statistically ensured production growth that is significant, distinctly significant and very significant (Tab.6).

Table 6. also emphasizes the idea that soy uses better the water supplied by irrigation at 50% of the AHI, whether the chisel plow is used or not, and with all tillage accomplished. Thus, the highest yield is obtained in the versions irrigated with 50% of the AHI (*Felicia Cchetan et a 2014l*).

CONCLUSION

The soy crop is demanding in terms of water. The analysis of the results obtained leads to the following conclusions:

Soy uses well the water administered in norms of 50% of the AHI, obtaining higher yields even than those obtained in conditions of irrigation with 100% of the AHI.

Tab.2. Soy production under the influence of tillage (chisel plow work),Valul lui Traian, 2008-2010

Crt .nr.	The variant	Production		Difference	Semnficant
		Kg/ha	%	Kg/ha	
1	Scarificat	2554	100	Mt	
2	Nescarificat	2421	94	-133	

DL 5% 18.30 kg/ha DL1% 91.67 kg/ha DL 0,1% 916.73 kg/ha

Tab. 3. Soy production under the influence of tillage and chisel plow work permanence, Valul lui Traian, 2008-2010

Crt .nr.	The variant	Production		Difference	Semnficant
		Kg/ha	%	Kg/ha	
1	Arat	2588	100	Mt	Mt
2	Cizel	2410	93	-178	000
3	Vibromixt	2463	95	-125	000

DL 5% 2,01 kg/ha DL1% 2,74 kg/ha DL 0,1% 3,67 kg/ha

Tab. 4. Soy production obtained as an effect of the interaction between water supply and chisel plow work, Valul lui Traian, 2008-2010

Crt .nr.	The variant		Production		Difference	Semnficant
	Irigat	Scarif./Nscr.	Kg/ha	%	Kg/ha	
1	100%	Scarif.	2560	100	Mt	Mt
2	100%	Nescarf.	2493	97	-67	000
3	50%	Scarif.	2757	107	197	***
4	50%	Nescarf.	2691	105	131	***
5	0%	Scarif.	2244	87	-316	000
6	0%	Nescarf.	2178	85	-382	000

DL 5% 5,95 kg/ha DL1% 9,01 kg/ha DL 0,1% 14,48 kg/ha

Tab. 5. Soy production under the influence of the interaction between tillage and irrigation, Valul lui Traian, 2008-2010

Crt .nr.	The variant		Production		Difference	Semnficant
	Lucr.sol	Irigat	Kg/ha	%	Kg/ha	
1	A	100%	2728	100	Mt	Mt
2	C	100%	2418	88	-310	000
3	VB	100%	2552	93	-176	000
4	A	50%	2983	107	225	***
5	C	50%	2920	107	192	***
6	VB	50%	2978	109	250	***
7	A	0%	2053	75	-675	000
8	C	0%	1892	69	-836	000
9	VB	0%	1860	68	-869	000

DL 5% 3,50 kg/ha DL1% 4,76 kg/ha DL 0,1% 6,37 kg/ha

Tab. 6. Soy production obtained as an effect of tillage and different water supply regimen, with the use of the chisel plow

Crt .nr.	The variant			Production		Difference		Semnficant	
	Irigat	Scarif./Nscr	Soil wock	Kg/ha	%	Kg/ha	Kg/ha		
1	100%	Scarif.	A	2866	182	1294	1095	***	***
2	100%	Scarif.	C	2385	151	813	614	**	*
3	100%	Scarif.	VB	2329	148	757	558	**	*
4	100%	Nescarf.	A	2591	164	1019	820	***	**
5	100%	Nescarf.	C	2451	155	879	680	**	**
6	100%	Nescarf.	VB	2774	176	1202	1003	***	***
7	50%	Scarif.	A	2740	174	1168	969	***	***
8	50%	Scarif.	C	2899	184	1327	1128	***	***
9	50%	Scarif.	VB	3101	197	1529	1330	***	***
10	50%	Nescarf.	A	3226	205	1654	1455	***	***
11	50%	Nescarf.	C	2942	187	1370	1171	***	***
12	50%	Nescarf.	VB	2856	181	1284	1085	***	***
13	0%	Scarif.	A	2335	148	763	564	**	*
14	0%	Scarif.	C	2181	138	609	410	*	*
15	0%	Scarif.	VB	2148	136	576	377	*	
16	0%	Nescarf.	A	1771	112	199	Mt		
17	0%	Nescarf.	C	1603	101	31	168		
18	0%	Nescarf.	VB	1572	100	Mt	199		

DL 5% 494 kg/ha DL1% 672 kg/ha DL 0,1% 900 kg/ha

In regards to tillage, the production obtained was not very different from one version to the other.

Even though the productions were similar, the technological expenses made the difference as the irrigated crops had the greatest ratio.

The tillage system using the chisel and the vibromix can be the alternative to tillage by plowing in the pedoclimatic conditions of Dobrudja, providing a better preservation of the physical, chemical and humidity properties of the soil.

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