RESEARCH ON THE INFLUENCE OF TECHNOLOGY ON SOYBEABEAN CROP IN THE ROMANIAN PLAIN

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Soybean is one of the agricultural crops central to insuring protein resources both for humans and for animals. In addition it has the capacity to enter into a symbiotic relationship with *Rhizobium japonicum,* a process which results in the fixation of a large amount of nitrogen.
The optimization of the production process is the aim of any farmer.
The research which was carried out proved that significant production boosts may be gained through a combination of the technological elements of weed control and fertilization levels.

Key words: Technological elements; Weed control; Fertilization formula; Weed coverage; Production.

INTRODUCTION

Soybean provides a high amount of high quality and economic nutrients necessary in human and animal diets. Soybean has an agrotechnical importance thanks to the symbiotic relationship with the Bradyrhizobium bacteria (*Rhizobium japonicum)* which results in an increase of 60 to 90 kilos of nitrogen per hectare and reduces the demand for nitrogen fertilizers. In the first stage of the growing season, during the first 4 to 5 weeks after emergence, soybean crop is sensitive to weed coverage and defective weed control in this period leads to production decreases which could even compromise it.

The objective of the research was to quantify the impact of weed control methods and of fertilization on soybean yield, to identify the best technological elements, to observe how different agrophytotechnical treatments result in variations in the plant component of the biocenosis and foremost on the growth and development of soybean plants, production and on some of its quality indicators, as well as on the process of symbiosis of soybean plants with the nitrogen-fixating bacteria (*Bradyrhizobium japonicum*) and to determine the influence of agrophytotechnical measures on weeds and their influence on soybean yields.

MATERIALS AND METHODS

In order to attain these objectives in the period 2004–2009, a bifactorial (2×5) experiment was set up, where

Factor A: Fertilization with 2 graduations: $a_1 = N_0P_0$; $a_2 = N_{100}P_{50}$

Factor B: Weed control tillage, with 5 graduations:

b_1 – no tillage

b_2 – 2 mechanical hoeings + row weeding

b_3 – 2 mechanical hoeing + row herbiciding (Pulsar 0.3l/ha+ Fusilade 0.3/ha)

b_4 – preemergent herbiciding (Dual Gold 1,5l/ha) + mechanical hoeing

b_5 – preemergent herbiciding (Dual Gold 1,5l/ha).

The research was performed unde the pedoclimatic conditions of Moara Domneasca on a reddish preluvosoil, with a humus content of 2.35%.

Except for the applications specific of each treatment, all treatments received the same applications.

Phosphorus fertilizers were applied in autumn, before plowing and nitrogen fertilizers were applied before the preparation of the seedbed.

RESULTS AND DISCUSSIONS

Determining the weed coverage of soybean crop three weeks after crop emergence (Table 1)

The findings lead to the following reasoning:

– So far the application of fertilizers hasn't influenced the weed coverage of the crop;

– The applications of preemergent herbicides reduced the weed coverage of the crop compared to the witness treatments. In comparison with the witness treatment with no tillage, the application of preemergent herbicides led to a very significant reduction in the number of weeds per square metre, for both studied fertilization formulas and as well as for the mean values for factor A.

Determining the weed coverage rate of soybean crop three weeks after performing the first tillage (Table 2). When analysing the table data there can be seen:

– In the fertilized crop, during the first three weeks, the weed coverage rate was on average smaller in comparison with the no till treatments. This phenomenon took place because the soybean plants developed faster in the fertilized crop and they prevented (reduced) the further occurence of weed emergence.

– In the treatments where weed control was performed in May (row howing or herbiciding on the plant row), the weed coverage rate was smaller on average for both fertilization formulas. The differences between the treatments with row weeding and row herbiciding aren't statistically assured, these kinds of till having a practically similar effect.

– Concerning the effectiveness against weeds, the treatments of the experiment go as follows:

1. The $N_{100}P_{50}$ fertilization formula reduced the weed coverage rate in comparison with the N_0P_0 fertilization formula.
2. In the $N_{100}P_{50}$ fertilization formula, compared with N_0P_0, all till determined lower values of weed numbers.

The differences favouring the $N_{100}P_{50}$ fertilization formula aren't statistically assured, but given the general occurence of the phenomenon, it can be concluded that in the $N_{100}P_{50}$ fertilization formula, the fertilized soybean plants developed better and prevented the emergence of some weeds.

Table 1

Weed coverage of soybean crop (no/sqm) when performing the first tillage in the growing season, averages of 2005–2008

Weed coverage of the soybean crop (no/sqm) *Mean values 2005–2008*

		The influence of weed control methods for the same fertilization formula Interaction B × A				**The influence of weed control methods Factor B**	
	Weed control	a_1 N_0P_0	Dif a_1b_n- a_1b_1	a_2 $N_{100}P_{50}$	Dif a_2b_n- a_2b_1	Mean b	Dif b_n- b_1
b_1	No till	113	Mt	110	Mt	112	Mt
b_2	2 mechanical hoeings+ row weeding	112	-1	110	-1	111	-1
b_3	2 mechanical hoeings+ row herbiciding (Pulsar 0,3l/ha + Fusilade 0,3/ha)	115	3	109	-2	112	0
b_4	preemergent herbiciding(Dual Gold 1,5l/ha) + mechanical hoeing	17	-96^{000}	15	-95^{000}	15	-97^{000}
b_5	preemergent herbiciding(Dual Gold 1,5l/ha)	16	-97^{000}	14	-96^{000}	15	-97^{000}
		The influence of the fertilization formula Factor A					
			Dif b_n– b_1				
a_1	N_0P_0	74	Mt				
a_2	$N_{100}P_{50}$	72	-2				

	DL 5%	DL 1%	DL 0,1%
A	5,2	7,1	9,8
B	4.4	6.8	11.1
B × A	6,1	10,1	14,1

Table 2

The weed coverage rate of soybean crop (no/sqm) three weeks after performing the first till in the growing season, mean values of 2005–2008

Weed coverage of the soybean crop (no/sqm) *Averages 2005–2008*

		The influence of weed control methods for the same fertilization formula Interaction B × A				**The influence of weed control methods Factor B**	
	Weed control	a_1 N_0P_0	Dif a_1b_n- a_1b_1	a_2 $N_{100}P_{50}$	Dif a_2b_n- a_2b_1	Mean b	Dif b_n- b_1
b_1	No till	140	**Mt**	128	**Mt**	133.5	**Mt**
b_2	2 mechanical hoeings+ row weeding	23	-118	18	-110	19.5	-114
b_3	2 mechanical hoeings+ row herbiciding (Pulsar 0,3l/ha + Fusilade 0,3/ha)	28	-112	23	-105	24.5	-109
b_4	preemergent herbiciding(Dual Gold 1,5l/ha) + mechanical hoeing	25	-115	18	-110	21	-112.5
b_5	preemergent herbiciding(Dual Gold 1,5l/ha)	37	-103	27	-101	43	-90.5
		The influence of the fertilization formula Factor A					
			Dif b_n– b_1				
a_1	N_0P_0	52	Mt				
a_2	$N_{100}P_{50}$	45	-7				

	DL 5%	DL 1%	DL 0,1%
A	2.75	3.85	6.15
B	5.75	7.65	10.8
B × A	7.3	10.35	15.4

Weed coverage rate of soybean crop three weeks after performing the first till (Fig. 1). The findings of the measurements carried out three weeks after performing the first till in the growing season show that:

a. In the fertilized crop, compared to the treatments with no fertilization the weed coverage rate was on average 13% lower;

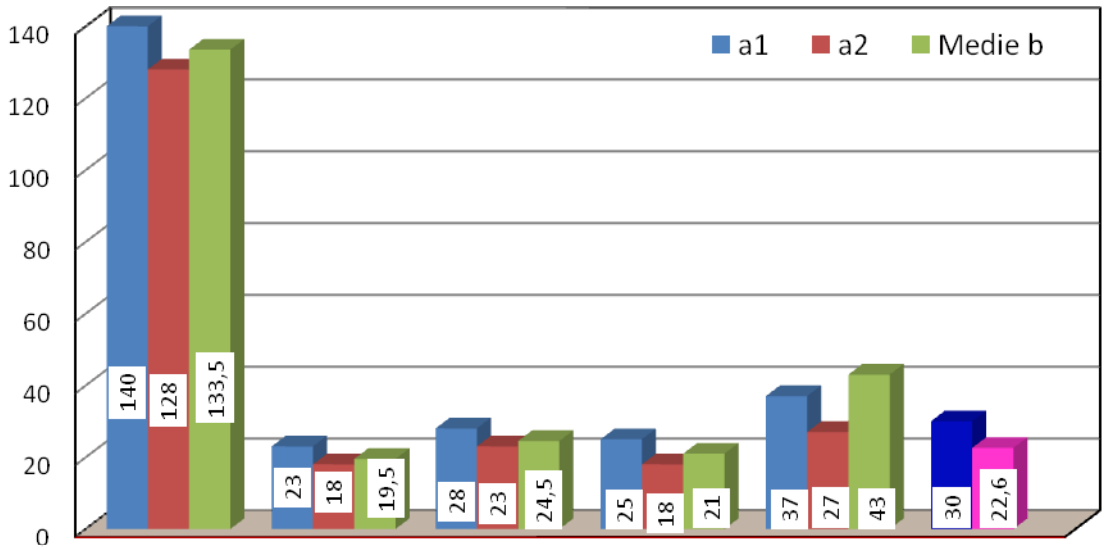

Fig. 1

Weed coverage rate of soybean crop before harvesting soybean crop

The numerical findings of the measurements of the weed coverage rate carried out in autumn, before harvesting soybean crop were the following (Table 3):

In comparison with the N_0P_0 fertilization formula, fertilization reduced very significantly the weed coverage rate for all 5 till treatments,

The weed control till, compared with the treatment with no till, reduced the weed coverage rate for both studied fertilization formulas as well as for the mean values.

The lowest weed coverage rate was recorded in the treatments with 2 mechanical hoeings and row weeding (b_2), or 2 mechanical hoeings and row herbiciding (Pulsar 0.3l/ha + Fusilade 0.3/ha) (b_3). A higher weed coverage rate was recorded in the treatments with preemergent herbiciding (b_4 and b_5).

The findings of the quantitative measurements of the weed coverage rate of soybean crop before harvesting (Table 4) show that:

The fertilization with $N_{100}P_{50}$ didn't produce significant changes in weed biomass,

Weed control till reduced very significantly weed biomass for both tested fertilization formulas.

The treatments with preemergent herbiciding only, weed control was poor

The aforementioned prove that the effectiveness (and the efficiency) of fertilization and weed control can be properly assessed if the weed coverage rate is measured using both methods (numerical and quantitative).

Soybean production, mean values for the studied period (Table 4). Their examination leads to the following conclusions:

– Soybean production was favoured both by fertilizers and by weed control;

– The fertilization of soybean with $N_{100}P_{50}$ in the studied period determined a mean production boost of 343.7 compared with the treatment with no fertilization.

– Therefore, soybean crop has a favourable reaction to nitrogen and phosphorus fertilization in the soil of Moara Domneasca, even if a part of the nitrogen amount is provided by the symbiotic process.

– Weed control till is also an important factor for the production boost. On average, for the two fertilization formulas, the studied till increased production 4-5 times.

In comparison with the treatment with 2 mechanical hoeings and row weeding which weed considered witness (for ecological reasons), in the treatment with no till soybean production was 1850kg/ha lower

The comparisons among treatments, in each fertilization formula, highlight that in three treatments with weed control till, almost the same production levels are reached (the differences aren't statistically assured). There can be also seen that in each fertilization formula, the treatment with preemergent herbiciding with 1.5 l Dual/ha the production was lower than for the witness and statistically assured.

– The comparisons to the production of the witness treatment (N_0P_0 + 2 mechanical hoeing + row weeding) lead to the following conclusions:

a. Under no fertilization (N_0P_0), three tilled treatments have similar productions, with no statistical assurance.

b. The $N_{100}P_{50}$ fertilization formula for three treatments with weed control (the same kind as for N_0P_0) led to statistically assured production boosts compared to the witness.

Table 3

The weed coverage rate of soybean crop (no/sqm) before harvesting soybean crop, mean values of 2005–2008

Weed coverage of the soybean crop (no/sqm) *Averages 2005–2008*

		The influence of weed control methods for the same fertilization formula Interaction B × A				**The influence of weed control methods Factor B**	
	Weed control Factor B	a_1 N_0P_0	Dif a_1b_n- a_1b_1	a_2 $N_{100}P_{50}$	Dif a_2b_n- a_2b_1	Mean b	Dif b_n- b_1
b_1	No till	133	**Mt**	123	**Mt**	128	**Mt**
b_2	2 mechanical hoeings+ row weeding	29	-104^{000}	25	-99^{000}	27	-101^{000}
b_3	2 mechanical hoeings+ row herbiciding (Pulsar 0.3l/ha + Fusilade 0.3/ha)	28	-105^{000}	24	-99^{000}	28	-100^{000}
b_4	preemergent herbiciding(Dual Gold 1.5l/ha) + mechanical hoeing	35	-98^{000}	27	-97^{000}	31	-97^{000}

Table 3 (continued)

b_5	preemergent herbiciding(Dual Gold 1.5l/ha)	49	-84^{000}	41	-82^{000}	45	-83^{000}
		The influence of the fertilization formula Factor A					
	Fertilization Factor A		Dif $b_n - b_1$				
a_1	N_0P_0	55	**Mt**				
a_2	$N_{100}P_{50}$	48	-7^{000}				

	DL 5%	DL 1%	DL 0,1%
A	2.4	3.8	6.6
B	4.9	7.17	11.7
B × A	6.0	8.1	11.3

Table 4

The weed coverage rate of soybean crop (kg/ha d.s.) before harvesting soybean crop, mean values of 2005–2008

Weed coverage of the soybean crop (no/sqm) *Averages 2005–2008*

		The influence of weed control methods for the same fertilization formula Interaction B × A				**The influence of weed control methods Factor B**	
	Weed control Factor B	a_1 N_0P_0	Dif $a_1b_n - a_1b_1$	a_2 $N_{100}P_{50}$	Dif $a_2b_n - a_2b_1$	Mean b	Dif $b_n - b_1$
b_1	No till	750	**Mt**	731	**Mt**	741	**Mt**
b_2	2 mechanical hoeings+ row weeding	189	-561^{000}	196	-535^{000}	192	-548^{000}
b_3	2 mechanical hoeings+ row herbiciding (Pulsar 0,3l/ha + Fusilade 0,3/ha)	183	-567^{000}	202	-529^{000}	193	-549^{000}
b_4	preemergent herbiciding(Dual Gold 1,5l/ha) + mechanical hoeing	206	-544^{000}	215	-516^{000}	210	-530^{000}
b_5	preemergent herbiciding(Dual Gold 1,5l/ha)	319	-431^{000}	297	-435^{000}	186	-555^{000}
		The influence of the fertilization formula Factor A					
	Fertilization Factor A		Dif $b_n - b_1$				
a_1	N_0P_0	330	**Mt**				
a_2	$N_{100}P_{50}$	328	-2				

	DL 5%	DL 1%	DL 0,1%
A	11.1	16.5	28.1
B	13.6	18.76	33.3
B × A	22.3	32.9	57.1

Table 4

Productions of soybean (kg/ha), mean values of 2005–2008

Averages 2005–2008

		The influence of weed control methods for the same fertilization formula Interaction B × A				**The influence of weed control methods Factor B**	
	Weed control Factor B	a_1 N_0P_0	Dif $a_1b_n - a_1b_1$	a_2 $N_{100}P_{50}$	Dif $a_2b_n - a_2b_1$	Medie b	Dif $b_n - b_1$
b_1	No till	296.7	-1780.0	516.7	-1920.0	406.7	-1850.0
b_2	2 mechanical hoeings+ row weeding	2076.7	**Mt**	2436.7	**Mt**	2256.7	**Mt**
b_3	2 mechanical hoeings+ row herbiciding (Pulsar 0,3l/ha + Fusilade 0,3/ha)	2073.3	-3.3	2503.3	66.7	2288.3	31.7
b_4	preemergent herbiciding(Dual Gold 1,5l/ha) + mechanical hoeing	1991.7	-85.0	2353.3	-83.3	2172.3	-84.3
b_5	preemergent herbiciding(Dual Gold 1,5l/ha)	1703.3	-373.3	1996.7	-440.0	1850.0	-406.7
		The influence of the fertilization formula Factor A					
	Fertilization Factor A		Dif $b_n - b_1$				
a_1	N_0P_0	1628.3	**Mt**				
a_2	$N_{100}P_{50}$	1972.0	343.7^{**}				

	DL 5%	DL 1%	DL 0,1%
A	138.3	230	480
B	193	350	608.3
B × A	370	510	740

CONCLUSIONS

The fertilization with $N_{100}P_{50}$ didn't influence the weed coverage rate of soybean crop significantly.

Weed control significantly reduced the weed coverage rate of soybean crop for all three determinations.

Soybean productions were very significantly higher when fertilizing with $N_{100}P_{50}$ and weed control methods determined production boosts 4-5 times higher.

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