RESEARCH REGARDING THE INFLUENCE OF CROP TECHNOLOGY, WATER SUPPLY AND CULTIVATED GENOTYPE ON SOYBEAN YIELD UNDER CONTEXT OF EFFICIENT UTILIZATION OF LIMITER WATER AND ENERGY RESOURCES

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Abstract: *Aim of studies and researches - By the performed researches, the optimization of crop technology, water supply and best genotype was followed, with a view to achieve maximum soybean yield in the south of the country, under economical efficiency and environment preservation. Thus, after joining Romania to EU, the obtainment of economically yields and in respect of environment preservation is a major objective. Stage of the research - There were no similar researches performed in Mostistea Plain and for maize. Materials and methods - The researches were performed during 2005-2007, in Mostistea Plain, by a tri-factorial experiment, such as: A = crop technology, with graduations: a_1= N_0 P_{60} , bacterized, a_2= $N_{40}P_{60}$, bacterized; B = Irrigation regime, with graduations: b_1= dry land, b_2= irrigated 50% AMI (active moisture interval), on 0-80 cm, with m=800 m^3/ha, by overhead irrigation, b_3= irrigated 50% AMI, on 0-40 cm, with $^1/_2$ m=400 m^3/ha, by overhead irrigation, b_4= irrigated 50% AMI, on 0-80 cm, with m=400 m^3/ha, by drip irrigation, b_5= irrigated 50% AMI, on 0-40 cm, with $^1/_2$ m=200 m^3/ha, by drip irrigation; C = Cultivated genotype, with graduations: c_1= Românesc 99, c_2= Triumf, c_3= Danubian. Novelty degree - Within the technological variants utilized in soybean crop, a « high-tech » technology was chosen, un-utilized in Romania till now, namely drip (sprinkle) irrigation. Stage of the achievements - By the researches performed under different irrigated areas of Romania, one can ascertain that there is a possibility to diminish the irrigation norm, by low limited water supply, with 15-30%.. Limits of the researches - There were no similar researches in other areas of the country. Practical implications of the researches - The achieved results establish the level of water supply, as well as the most efficient irrigation method in soybean, based on principle "much more with much less". Originality of the paper - The paper presents high originality, there are no similar papers, till present, in Mostistea Plain. It also presents a new approach of water supply diminution, as utilization of some new and performance watering methods. Importance of the paper - Having in view the high cost of the irrigation water, the diminution of irrigation norm, by utilizing new performance methods has direct impact on economical indicators.*

Key words : *limited water supplying; watering rate; irrigation norm; water consumption,drought*

INTRODUCTION

On world plane, the drought and desertification affect approximately 47% of land, with various degree of aridization. In Europe, the hydric deficit affects 300 millions ha (32% of continent) and in Romania, 4 millions ha, of which 2.9 millions agricultural land, fact that imposes the adaptation of agricultural system, elaboration of new methods and techniques to efficiently utilize the irrigation water, development of irrigation equipments.

During last 15 years, one can ascertain an increasing of areas affected by drought, all over the country and a diminution of water reserves. The most important measure to avoid the drought is the crop irrigation, performed, on world plane, on 300 millions ha and in Romania, on 3 millions ha, measure under different stages of exploitation and re-habilitation.

Under both joining Romania to EU and current market economy, the obtainment of economically high and stable yields which preserve environment become a stringent necessity. The tolerance to drought of genotypes currently cultivated presents a special importance under natural Romania conditions, because the critical stages for water during vegetation period, correspons to droughty periods.

MATERIALS AND METHODS

By the performed researches, the optimization of crop technology, water supply and best genotype was folowed, to achieve maximum soybean and maize yield, in the South of the country, under economical efficiency and environment preservation.

To assess the objectives of this study, a poly-factorial experiment, 2 x 5 x 3 type, in subdivided plots, with three reps, was performed at NARDI Fundulea.

A = Crop technology, with graduations:

a_1= N_0 P_{60} , bacterized

a_2= $N_{40}P_{60}$, bacterized

B = Irrigation regime, with graduations:

b_1= dryland

b_2= irrigated 50% AMI, on 0-80 cm, with m=800 m^3/ha, by overhead irrigation

b_3= irrigated 50% AMI, on 0-40 cm, with $^1/_2$ m=400 m^3/ha, by overhead irrigation

b_4= irrigated 50% AMI on 0-80 cm, with m=400 m^3/ha, by drip irrigation

b_5= irrigated 50% AMI on 0-40 cm, with $^1/_2$ m=200 m^3/ha, by drip irrigation

C = Cultivated genotype, with graduations:

c_1= Românesc 99

c_2= Triumf

c_3= Danubian

Two crop technologies were used, one of them specific to irrigated crops and the other to dryland, five irrigation variants and three genotypes. The watering application was performed during different vegetation stages, following that the soil moisture do not decreases below P_{min} of 50 % AMI, no matter of irrigation method or variant.

To estimate the watering rate, the weighted values of physical and hydro-physical indices of Fundulea's soils for 0.8 layer, respectively 0.4 one, were used.

RESULTS AND DISCUSSION

The yield data obtained into field were processed by ANOVA, and the breaker between variants was done by limit-differences. The influence of crop technology on soybean yield, during 2005-2007 is presented in table 1 and figure 1.

During experimentation period, in technological variant a_2-$N_{40}P_{60}$ bacterized, no yield gains statistically ensured vs. technological variant a_1- N_0P_{60} bacterized, were achieved.

Table 1

Influence of crop technology on soybean yield, during 2005- 2007

Factor A	Yield		Vs. a_1- P_{60} bacterized	
	q/ha	rel. %	Diff. q/ha	Signif.
a_1 - N_0 P_{60} bacterized	29.83	100	check	
a_2 - N_{40} P_{60} bacterized	29.34	98.37	-0.48	-

LSD 5%= 1.26 q/ha LSD 1%= 2.31 q/ha LSD 0.1%= 5.13 q/ha

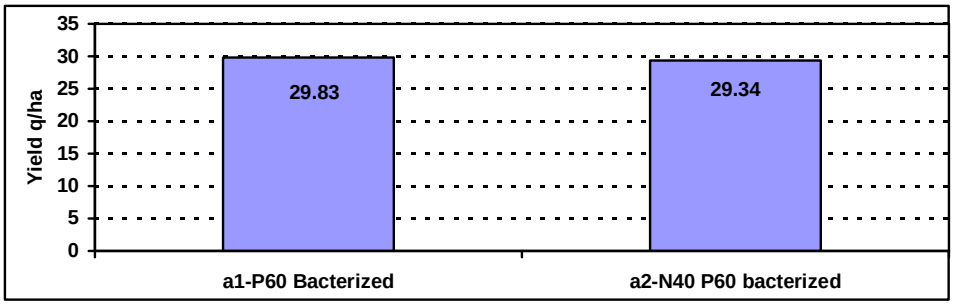

Figure 1 Influence of crop technology on soybean yield, during 2005- 2007

Table and figure 2 present the influence of irrigation regime on soybean yield, during 2005-2007. The very significant highest yield gains vs. dryland variant were of 12.5 q/ha, respectively de 12.82 q/ha, obtained in irrigation variants b_2-irrigated at 50 % AMI, on 0-80 cm depth, by overhead irrigation with 800 m^3/ha and b_4-irrigated at 50 % AMI, on 0-80 cm depth, by drip irrigation with 400 m^3/ha .

Table 2

Influence of irrigation regime on soybean yield, during 2005- 2007

Factor B	yield		Vs. b_1- dryland	
	q/ha	rel. %	Diff .q/ha	Signif.
b_1- dryland	21.1	100	check	-
b_2- irrigated on 0 - 80 cm, at Pmin - 50 % AMI with 800m^3 ha, by overhead irrigation	33.60	159.26	12.5	***
b_3- irrigated on 0 - 40 cm , at Pmin - 50 % AMI with 400 m^3 ha, by overhead irrigation	29.93	141.87	8.83	***
b_4- irrigated on 0 - 80 cm , at Pmin - 50 % AMI with 400 m^3 ha, by drip irrigation	33.92	160.77	12.82	***
b_5- irrigated on 0 - 40 cm , at Pmin - 50 % AMI with 200 m^3 ha, by drip irrigation	29.38	139.24	8.28	***

LSD 5%= 1.10 q/ha LSD 1%= 1.50 q/ha LSD 0,1%= 2.00 q/ha

Table and figure 3 present the influence of cultivated genotype on soybean yield, during 2005-2007. The cultivars Triumf and Danubian achieved very significant yield gains vs. check Romanesc 99, of 5.87, respectively 4.22 q/ha. Thus, the cultivation of these two varieties could determine yield gains vs. check Romanesc 99 between 16% and 22%.

Data synthesis regarding the influence of crop technology, irrigation regime and cultivated genotype on soybean yield, in 2007.

On three-years experimentation average, in technological variant a_1-N_0P_{60} bacterized, yield of 29.83 q/ha was achieved, and in variant a_2-$N_{40}P_{60}$ bacterized, and yield of 29.34 q/ha was achieved. As regards the average yields due to influence of irrigation variants, the highest yields, of 33.6 q/ha, respectively 33.92 q/ha were achieved in variants b_2-irrigated at 50 % AMI, on 0-80 cm depth, by overhead irrigation with 800 m^3/ha şi b_4-irrigated at 50 % AMI, on 0-80 cm depth, by drip irrigation with 400 m^3/ha .

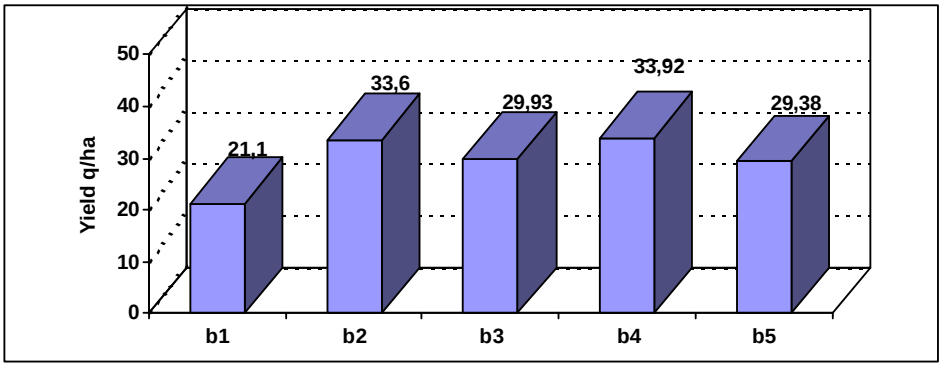

Figure 2. Influence of irrigation regime on soybean yield, during 2005- 2007

Table 3

Influence of cultivated genotype on soybean yield, during 2005- 2007

Factor C	Yield		Vs. c_1- Românesc 99	
	q/ha	rel. %	Diff .q/ha	signif.
c_1= Românesc 99	26.22	100	check	
c_2= Triumf	32.10	122.40	5.87	***
c_3= Danubian	30.44	116.08	4.22	***

LSD 5%= 0.66 q/ha LSD 1%= 0.87 q/ha LSD 0,1%= 1.14 q/ha

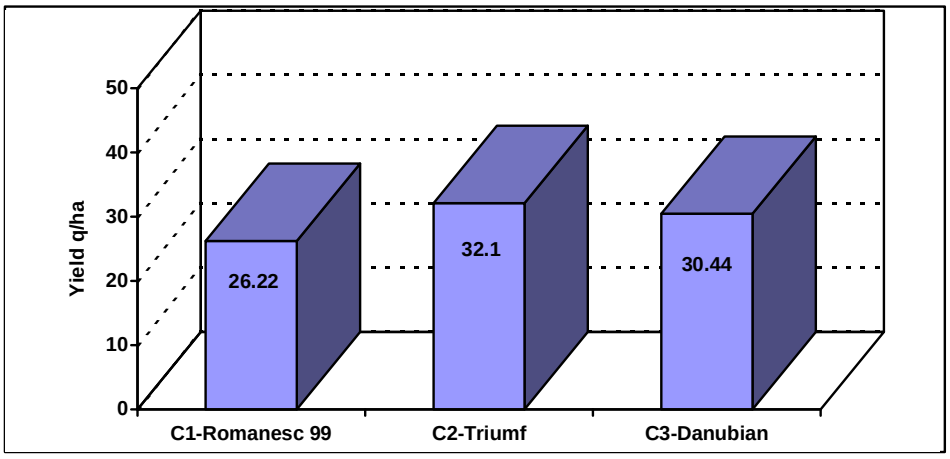

Figure 3 Influence of irrigation regime on soybean yield, during 2005- 2007

Table 4

Data synthesis regarding the influence of crop technology, irrigation regime and cultivated genotype on soybean yield, in 2007

Variant		a_1 - N_0 P_{60} bacterized	a_2 - N_{40} P_{60} bacterized	average
b_1- dryland	c_1= Românesc 99	18.04	17.09	17.57
	c_2= Triumf	23.1	23.02	23.06
	c_3= Danubian	23.48	21.86	22.67
	average	21.54	20.66	21.10
b_2- irrigated on 0-80 cm, at Pmin 50 % AMI, with 800m^3 ha, by overhead irrigation	c_1= Românesc 99	30.96	30.38	30.67
	c_2= Triumf	36.32	37.15	36.74
	c_3= Danubian	33.97	32.84	33.41
	average	33.75	33.46	33.60
b_3- irrigated on 0-40 cm, at Pmin 50 % AMI, with 400m^3 ha, by overhead irrigation	c_1= Românesc 99	26.92	27.34	27.13
	c_2= Triumf	31.4	32.42	31.91
	c_3= Danubian	31.48	30.04	30.76
	average	29.93	29.93	29.93
b_4- irrigated on 0-80 cm, at Pmin 50 % AMI, with 400m^3 ha, by drip irrigation	c_1= Românesc 99	30.55	30.82	30.69
	c_2= Triumf	36.99	35.38	36.19
	c_3= Danubian	34.44	35.35	34.90
	average	33.99	33.85	33.92
b_5- irrigated on 0-40 cm, at Pmin 50 % AMI, with 200m^3 ha, by drip irrigation	c_1= Românesc 99	26.24	23.9	25.07
	c_2= Triumf	33.08	32.12	32.60
	c_3= Danubian	30.48	30.46	30.47
	average	29.93	28.83	29.38
average	c_1= Românesc 99	26.54	25.90	26.22
	c_2= Triumf	32.18	32.02	32.10
	c_3= Danubian	30.77	30.11	30.44
General average		**29.83**	**29.34**	**29.58**

LSD value	Dl 5 %	Dl 1%	Dl 0,1%
For comparison between technological variants	1.26	2.31	5.13
For comparison between irrigation variants	1.10	1.50	2.00
For comparison between genotypes	0.66	0.87	1.14
Pentru comparaţii între variantele de irigare la aceeaşi tehnologie	1.82	2.48	3.32
For comparison between technological variants at the same irrigation one	1.84	2.80	4.78
For comparison between genotypes at the same technology	0.93	1.24	1.61
For comparison between genotypes at the same irrigation variant	1.47	1.95	2.54
For comparison between irrigation variants at the same cultivated genotype	1.63	2.19	2.88
For comparison between technological variants at the same cultivated genotype	1.43	2.37	4.61
For comparison between genotype at the same irrigation variant and applied technology	2.08	2.76	3.59
For comparison between irrigation variants at the same technological variant and	2.30	3.09	4.07
For comparison between technological variants at the same irrigation variant and	2.49	3.56	5.40

The cultivar Triumf achieved the highest average yield, of 32.10 q/ha, followed by Danubian, with 30.44 q/ha and Romanesc 99, with 26.22 q/ha.

The highest average soybean yield, of 37.15 q/ha, was obtained by the cultivar Triumf, in technological variant a_2-$N_{40}P_{60}$ bacterized and irrigated by overhead with 800 m^3/ha and maintenance of Pmin at 50 % AMI, on 80 cm depth.

CONCLUSIONS AND RECOMMENDATIONS

- application of nitrogen fertilizers do not determine the obtainment of yield gains under bacterization of seeds; one can recommend the fertilization with only P_{60} ;

- method of watering is overhead irrigation, at rate of 800m^3/ha, which should ensure the soil moisture, on 80 cm depth, at Pmin of 50% AMI; under these circumstances, the possible yield is about 34 q/ ha ;

- a similar yield could be achieved by drip irrigation methods, with diminished rate of 400 m^3/ha; this irrigation technology is not recommended due to high cost of investments in watering equipment, although there is registered high economies in irrigation water.

- among the three tested genotypes, the cultivar Triumf proved to be superior as yield, of about 32 q/ha.

Studying the factors and their interaction, the following recommendations are emphasized :

- cultivation of the cultivar Triumf ;
- bacterization of crop and fertilization with N_0P_{60} ;
- application of waterings by overhead with a rate of 800 m^3/ha, which should ensure the soil moisture at Pmin of 50 % AMI, on 80 cm depth.

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