RESEARCH REGARDING THE INFLUENCE OF CROP TECHNOLOGY, WATER SUPPLY AND CULTIVATED GENOTYPE ON CWUE AND IWUE IN MAIZE, IN MOSTISTEA PLAIN

I. JINGA; Alina NIȚU; D.S. NITU

University of Agricultural Sciences and Veterinary Medicine, Bucharest Blvd. Mărăşti, no.59;
Corresponding author: oana_alina_mardare@yahoo.com

Abstract: *Aim of studies and researches - The aim of the research was to identify some technological links with high importance in maize crop technology under stress conditions, to establish the diminution level in irrigation and watering norms, as well as to find a Romanian hybrid capable to cover the farmer's requirements.A special element in decision analysis of technological recommendations is represented by the calculating the efficiency of each factor, useful to achieve a real yield gain. Thus, two very important synthetical indices were calculated, which clearly express the ratio between water and yield (CWUE and IWUE). Stage of researches - Similar researches were also performed in Mostistea Plain for soybean too, following the same aspects. Materials and methods - The researches were performed during 2005-2007, in Mostistea Plain, as tri-way experiment, as follows: A = Crop technology, with graduations: - a_1= $N_{100}P_{60}$ 40.000 pl/ha, - a_2= $N_{180}P_{60}$ 70.000 pl/ha; B = Irrigation regime, with graduations: - b_1= dryland, - 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= F475 M, - c_2= Paltin, - c_3= Campion. Novelty degree - Within the technological variants used in maize crop, a "last-generation" irrigation technology was chosen, no utilized in Romania till now, namely sprinkling (drip) irrigation. Stage of achievements - Based on the researches performed under different irrigated areas of Romania, one can ascertain that there is the possibility to diminish the irrigation norm in maize, with 15-30% . Limits of the research - No similar researches were performed in other areas of the country.Practical application of the research - The results achieved establish the level of water supply, as well as the most efficient irrigation method for maize, based on principle " to obtain more with much less". The paper originality - The paper presents high originality degrees, no similar papers were performed till now, in Mostistea Plain. Paper importance - Having in view the high cost of irrigation water, the diminution of irrigation norm, by utilizing the most performance methods, has direct involvements on economical indicators (production cost, benefit).*

Key words : *limited water supplying; watering rate; genotype; irrigation norm*

INTRODUCTION

By the performed researches, the identification of some technological tools was followed, with great importance in maize crop technology under stress conditions and establishment of diminishing watering and irrigation rates as well as the identification of a Romanian hybrid adequate to requirements of farmers, nowadays.

An important element in decisional analysis of technological recommendations is represented by efficiency calculation for each factor to achieve real yield gain, so that, in maize cultivated in Mostistea Plain, two economically very important indices were processed, namely CIWUE and IWUE.

MATERIALS AND METHODS

The researches were performed as a tri-factorial experiment, during 2005-2007, in Mostistea Plain, as follows:

A = Crop technology, with graduations:
a_1= $N_{100}P_{60}$ 40.000 pl/ha
a_2= $N_{180}P_{60}$ 70.000 pl/ha

B = Irrigation regime, with graduations:
b_1= drylanf
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 (sprinkle) 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= F475 M
c_2= Paltin
c_3= Campion

The firstly studied index was CIWUE, in m^3/kg, which expresses the efficiency of irrigation water in yield achieving, and the second was IWUE, or the efficiency of irrigation water, in kg/ m^3, which emphasizes the contribution (input) of each am^3 of water on yield gain.

CIWUE = irrigation rate / yield gain

IWUE = yield gain / irrigation rate

RESULTS AND DISCUSSION:

In table 1 and figure 1, the average values of CWU in maize, during 2005-2007 are presented. In technological variant a_2- $N_{180}P_{60}$ 70.000 pl/ha, the best CWU of 0.31 vs. 0.41 m^3/kg gain were achieved.

Also, on an average, in drip irrigation variants, a CWUE by overhead irrigation was achieved, 0.33 vs. 0,57m^3/kg.

As regards the cultivated genotype, the lowest average value, of 0.34 m^3/kg was obtained by Campion hybrid. The best absolute value of CWUE (0,20 m^3/kg) in maize, was achieved by the drip-irrigated hybrids Paltin and Campion, on 80 cm depth and 50% AMI, by application of 400 m^3/ha, in technological variant a_2- $N_{180}P_{60}$ 70.000 pl/ha.

Both table and figure2 present the second indicator in maize, IWUE.

Thus, in technological variant a_2- $N_{180}P_{60}$ 70.000 pl/ha, the best values were achieved, such as 2.45 vs. 1.83 kg/m^3 utilized irrigation water.

On an average, in drip irrigation variants, the best values of IWUE were achieved vs. overhead irrigation, such as 3.47 vs. 1.88 kg/m^3.

Regarding the cultivated genotype, the highest average value of IWUE, 3,28 kg/m^3, was obtained by the hybrid Campion.

The best absolute value of IWUE, 4.94 kg/m^3, in maize during 2005-2007 was obtained by the drip-irrigated hybrid campion, on 80 cm depth and 50% AMI, by application of 400 m^3/ha, in technological variant a_2- $N_{180}P_{60}$ 70.000 pl/ha, while the lowest one, of 1.17 kg/m^3, was obtained by the hybrid F 475 M, in technological variant a_1- $N_{100}P_{60}$ 40.000 pl/ha, by application of overhead irrigation with 400 m^3/ha, 50% AMI, on 40 cm depth.

Table 1

Coefficient of irrigation water use efficiency, in maize, during 2005-2007

VARIANT		No of waterings at emergence	No of waterings	Average of emergence rate (m^3/ha	Average of watering rate (m^3/ha)	Average of irrigation rate (m^3/ha)	CIWUE m^3 irrigation water / 1 kg gain		
IRRIGATION VARIANT	**IRRIGATION VARIANT**						a_1 - $N_{100}P_{60}$ 40.000 pl/ha	a_2 - $N_{180}P_{60}$ 70.000 pl/ha	Average A_1–A_2
b_1- dryland	c_1 - F 475 M	0	0	0	0	0	Mt	Mt	Mt
	c_2 - Paltin						-	-	-
	c_3 - Campion						-	-	-
AVERAGE							-	-	-
B_2- irrigated on 0-80 cm, at Pmin-50%AM, with 800m^3 ha by overhead irrigation	c_1 - F 475 M	0.33	2.33	83	800	1950	0.71	0.61	0.66
	c_2 - Paltin						0.62	0.40	0.51
	c_3 - Campion						0.52	0.36	0.44
AVERAGE							**0.62**	**0.46**	**0.54**
b_3- irrigated on 0-40 cm, at Pmin-50%AM, with 400m^3 ha by overhead irrigation	c_1 - F 475 M	0.33	4.67	83	400	1950	0.86	0.77	0.82
	c_2 - Paltin						0.67	0.45	0.56
	c_3 - Campion						0.51	0.39	0.45
AVERAGE							**0.68**	**0.54**	**0.61**
b_4- irrigated on 0-80 cm, at Pmin-50%AMI, with 400m^3 ha by drip irrigation	c_1 - F 475 M	0.33	2.33	83	400	1017	0.47	0.33	0.40
	c_2 - Paltin						0.30	0.20	0.25
	c_3 - Campion						0.26	0.20	0.23
AVERAGE							**0.34**	**0.24**	**0.29**
B_5- irrigated on 0-40 cm, at Pmin-50%AMI, with 200m^3 ha by drip irrigation	**c_1 - F 475 M**	0.33	4.67	83	200	1017	0.59	0.52	0.56
	c_2 - Paltin						0.34	0.22	0.28
	c_3 - Campion						0.26	0.23	0.25
AVERAGE							**0.40**	**0.32**	**0.36**
AVERAGE	**c_1 - F 475 M**						0.66	0.56	**0.61**
	c_2 - Paltin						0.48	0.32	**0.40**
	c_3 - Campion						0.39	0.30	**0.34**
AVERAGE							**0.41**	**0.31**	**0.36**

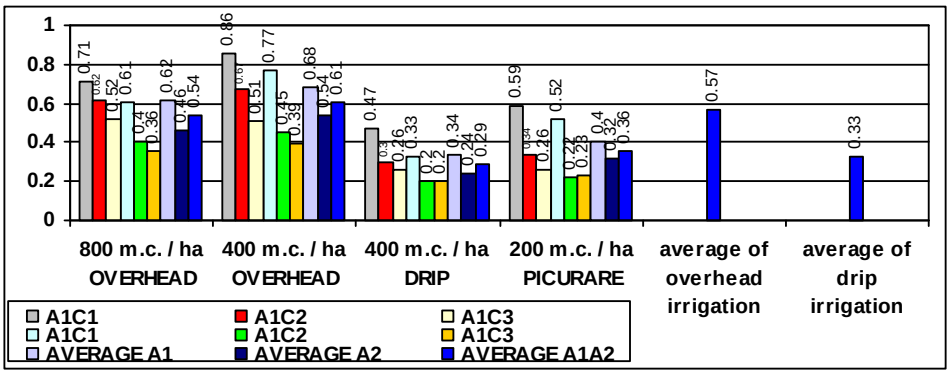

Figure 1 Coefficient of irrigation water use efficiency, in maize, during 2005-2007

Table 2

IWUE in maize, during 2005-2007

VARIANT		No of waterings at emergence	No of waterings	Average of emergence rate (m^3/ha	Average of watering rate (m^3/ha)	Average of irrigation rate (m^3/ha)	IWUE 1 kg gain / m^3 irrigation water		
IRRIGATION VARIANT	**IRRIGATION VARIANT**						a_1 - $N_{100}P_{60}$ 40.000 pl/ha	a_2 - $N_{180}P_{60}$ 70.000 pl/ha	Average A_1–A_2
b_1- dryland	c_1 - F 475 M	0	0	0	0	0	Mt	Mt	Mt
	c_2 - Paltin						-	-	-
	c_3 - Campion						-	-	-
AVERAGE							-	-	-
B_2- irrigated on 0-80 cm, at Pmin-50%AM, with 800m^3 ha by overhead irrigation	c_1 - F 475 M	0.33	2.33	83	800	1950	0.71	0.61	0.66
	c_2 - Paltin						0.62	0.40	0.51
	c_3 - Campion						0.52	0.36	0.44
AVERAGE							**0.62**	**0.46**	**0.54**
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	c_2 - Paltin						0.67	0.45	0.56
	c_3 - Campion						0.51	0.39	0.45
AVERAGE							**0.68**	**0.54**	**0.61**
b_4- irrigated on 0-80 cm, at Pmin-50%AMI, with 400m^3 ha by drip irrigation	c_1 - F 475 M	0.33	2.33	83	400	1017	0.47	0.33	0.40
	c_2 - Paltin						0.30	0.20	0.25
	c_3 - Campion						0.26	0.20	0.23
AVERAGE							**0.34**	**0.24**	**0.29**
B_5- irrigated on 0-40 cm, at Pmin-50%AMI, with 200m^3 ha by drip irrigation	**c_1 - F 475 M**	0.33	4.67	83	200	1017	0.59	0.52	0.56
	c_2 - Paltin						0.34	0.22	0.28
	c_3 - Campion						0.26	0.23	0.25
AVERAGE							**0.40**	**0.32**	**0.36**
AVERAGE	**c_1 - F 475 M**						0.66	0.56	**0.61**
	c_2 - Paltin						0.48	0.32	**0.40**
	c_3 - Campion						0.39	0.30	**0.34**
AVERAGE							**0.41**	**0.31**	**0.36**

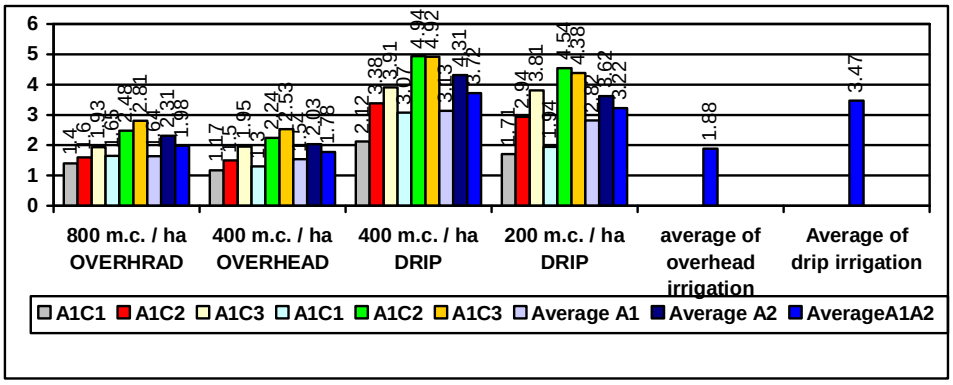

Figure 1 IWUE in maize, during 2005-2007

CONCLUSIONS

The utilization of irrigation water was established by the calculation of CWUE and IWUE.

The results emphasized that the best utilization of irrigation water (CWUE=0,20m^3 irrigation water /kg gain), in maize was obtained by cultivation of the drip-irrigated hybrid Campion, 70000 pl/ha, on $N_{180}P_{60}$ agro-background, using 400 m^3/ha watering rate, on 80 cm depth, 50% AMI.

Therefore, it is not recommended the application of drip irrigation in maize, having in view the dificulty and costs involved. It is recommended the cultivation of the hybrid Campion, with a density of 70 mii pl/ha, on $N_{180}P_{60}$ agro-background, irrigated by overhead with a rate of 800m^3/ha, on 80 cm depth, 50% AMI.

Using this recommendation, CWUE of 0,52 m^3 irrigation water/kg gain will be achieved in maize.

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