INVESTIGATIONS ON THE INFLUENCE OF SOME TECHNOLOGICAL FACTORS ON THE BIOMASS PRODUCTION IN MAIZE (*ZEA MAÏS* L.), FOR BIOFUEL, UNDER CONDITIONS OF LOWER BASIN OF THE SIRET RIVER

V. VÎNTU[1], C. SAMUIL[1], C.I. POPOVICI[1], T. ROBU[1]

[1] The University of Agricultural Sciences and Veterinary Medicine „Ion Ionescu de la Brad" Iaşi
e-mail: vvintu@uaiasi.ro

The strategy of the European Union for biofuels grounds on the use of biomass, while the farming production is assessed as a future alternative source for the energetic system. Biomass is an unconventional solid fuel source, with great heating power and low price, and is renewable in short time, which results in thermal power station working at low costs and high efficiency. One of these sources is maize, which ecological and economic advantages are highly assessed by specialists. The heating power of dry maize was estimated at 4.718-6.200 kcal/kg, thus greatly increasing the interest for the production and use of maize biomass as energy source. The goal of this paper was to study the influence of some technological factors on the biomass production in maize crop.

***Key words**: maize, biomass, productivity*

The strategy of the European Union for biofuels relies on the use of biomass and farming production is estimated as a future alternative source for the energetic system.

Biomass is an unconventional solid fuel source, with high heating power, low price and renewable in short time, which results in thermal power station working at low costs and high efficiency. Maize is one of these sources, the specialists assessing the ecological and economic advantages of this crop. Dry maize heat power is estimated at 4.718-6.200 kcal/kg, increasing significantly the interest for producing and using maize biomass as energy source [1, 2, 3, 4**].**

This scientific paper has an aim to study the influence of some technological factors on biomass production in maize crop.

MATERIAL AND METHOD

Trials were conducted on a leached chernozem with fine texture from the Siret Terrace at Vameşu locality, Galaţi County. The mean temperature during the vegetation period was of 20.5^{0}C, and the sum of rainfall amount in the same period was of 252.8 mm. Crop setting has observed the specific maize technology, under non-

irrigated. Trials were set up according the method of split-split plots in randomized blocks.

The experimental factors were:

Factor A – Sowing density:

- a_1 – 64500 plants/ha;
- a_2 – 75000 plants/ha.

Factor B – Fertilization:

- b_1 – Unfertilized control; b_2 – $N_{60}P_{40}$; b_3 – $N_{80}P_{40}$; b_4 – $N_{100}P_{40}$.

Factor C – Hybrid:

- c_1 – PR38V91; c_2 – PR37M34; c_3 – LG2306; c_4 – LG3330;
- c_5 – DR440; c_6 – DR4626.

In this trial, we have followed the effect of some technological links on gas-making biomass production in maize, for elaborating an efficient technology from the viewpoint of costs per unit of obtained energy. Harvesting was done at full grain maturity, yields were expressed in DM and the statistical interpretation was done by the analysis of variance.

RESULTS AND DISCUSSIONS

The DM yield obtained from the entire plant was comprised between 16.77 and 21.39 t/ha DM in the variant without fertilization and at a density of 64500 plants per ha, the most productive hybrid being DR4626. At a density of 75000 plants per ha, yield varied between 16.02 and 18.52 t/ha DM (*tab. 1*).

At the fertilization rate of $N_{60}P_{40,}$ yields varied between 18.64 and 23.74 t/ha DM at lower density, the most productive hybrid being DR 4626, while at a higher density, 17.49 – 18.99 t/ha were obtained, the most productive hybrid being DR 4626. At the fertilization with $N_{80}P_{40,}$ the obtained yields were comprised between 19.45 and 26.45 t/ha DM at the density of 64500 plants per ha and 16.56 – 22.19 t/ha DM at the density of 75000 plants per ha. The most productive hybrids were DR 440 at low density and DR 4626 at great density.

The use of a fertilization rate of $N_{100}P_{40}$ at the density of 64500 plants per ha has resulted in getting yields comprised between 19.82 and 26.96 t/ha DM, the most productive hybrid being DR 4626. At the density of 75000 plants per ha, the obtained yields were of 26.11 t/ha DM. Applying nitrogen rates comprised between 60-100 kg/ha a.i. has resulted in getting yield increases of 13-25%, at the density of 64500 plants per ha, which were statistically assured. At a higher density, yield increases were lower, comprised between -1% and 9%.

The highest fertilization rate was of $N_{100}P_{40}$ where 23.31 t/ha DM were obtained at the density of 64500 plants per ha and 20.29 t/ha DM, at the density of 75000 plants per ha (*tab. 2*).

Table 1

Influence of the experimental factors on maize yield, entire plant (t/ha DM)

Fertilisation	Hybrid	Density (plants/ha)							
		64500				75000			
		t/ha	%	Dif./ctr.	Signif.	t/ha	%	Dif./ctr.	Signif.
Unfertilized control	PR38V91	18.99	100	0.00	Control	17.35	100	0.00	Control
	PR37M34	18.98	99	0.01	-	16.02	92	-1.33	-
	LG2306	17.58	93	-1.4	-	16.21	93	-1.14	-
	LG3330	18.64	98	-0.35	-	16.79	97	-0.56	-
	DR440	16.77	88	-2.22	-	18.51	107	1.16	-
	DR4626	21.39	113	2.40	-	18.52	107	1.17	-
$N_{60}P_{40}$	PR38V91	22.17	117	3.18	-	19.80	114	2.45	-
	PR37M34	21.58	114	2.58	-	17.68	102	0.33	-
	LG2306	18.64	98	-0.35	-	18.80	108	1.45	-
	LG3330	20.72	109	1.73	-	18.14	105	0.79	-
	DR440	20.36	107	1.37	-	17.49	101	0.14	-
	DR4626	23.74	125	4.75	**	18.99	109	1.64	-
$N_{80}P_{40}$	PR38V91	26.22	138	7.23	***	19.52	113	2.17	-
	PR37M34	20.49	108	1.50	-	19.60	113	2.25	-
	LG2306	20.18	106	1.19	-	17.60	101	0.25	-
	LG3330	19.45	105	0.86	-	16.56	95	-0.79	-
	DR440	26.45	139	7.46	***	18.21	105	0.86	-
	DR4626	23.10	122	4.11	*	22.19	128	4.84	**
$N_{100}P_{40}$	PR38V91	22.27	117	3.28	-	16.96	98	-0.39	-
	PR37M34	21.82	115	2.83	-	23.12	133	5.77	**
	LG2306	19.82	104	0.83	-	18.77	108	1.42	-
	LG3330	21.69	114	2.70	-	16.73	96	-0.62	-
	DR440	27.32	144	8.33	***	20.04	115	2.69	-
	DR4626	26.96	142	7.97	***	26.11	150	8.76	***
		LSD 5% = 3.51 t/ha LSD 1% = 4.70 t/ha LSD 0.1 % = 6.17 t/ha							

Table 2

Influence of fertilization and density on maize yield, entire plant (t/ha DM)

Fertilization	Density (plants/ha)							
	64500				75000			
	t/ha	%	Dif./ctr.	Signif.	t/ha	%	Dif./ctr.	Signif.
Unfertilized control	18.73	100	0.00	Control	17.23	100	0.00	Control
$N_{60}P_{40}$	21.20	113	2.47	*	18.48	107	1.25	-
$N_{80}P_{40}$	22.71	121	3.98	**	18.95	110	1.72	-
$N_{100}P_{40}$	23.31	125	4.58	**	20.29	118	3.06	**
	LSD 5% = 2.01 t/ha LSD 1% = 3.04 t/ha LSD 0.1 % = 4.88 t/ha							

At a density of 64500 per ha, DR4626 and DR 440 hybrids were the most productive, being obtained yields of 23.80 t/ha DM, respectively, 22.73 t/ha DM.

At the density of 75000 plants per ha, the highest yield of 21.45 t/ha was obtained by DR 4626 hybrid. PR37M34 and DR 440 gave better yields, of 19.10 t/ha, respectively, 18.56 t/ha DM (*tab. 3*).

Table 3

Influence of the hybrid and density on maize yield, entire plant (t/ha DM)

Hybrid	Density (plants/ha)							
	64500				75000			
	t/ha	%	Dif./ctr.	Signif.	t/ha	%	Dif./ctr.	Signif.
PR38V91	22.41	100	0.00	Mt.	18.41	100	0.00	Mt.
PR37M34	20.72	92	-1.69	-	19.10	104	0.69	-
LG2306	19.05	85	-3.36	00	17.84	97	-0.57	-
LG3330	20.23	90	-2.18	0	17.06	93	-1.35	-
DR440	22.73	101	0.32	-	18.56	101	0.15	-
DR4626	23.80	106	1.39	-	21.45	117	3.04	**
	LSD 5% = 1.76 t/ha LSD 1% = 2.35 t/ha LSD 0.1 % = 3.09 t/ha							

CONCLUSIONS

The most productive hybrid was DR4626 where a DM yield of 23.8 t/ha was obtained at the density of 64500 plants/ha and of 21.45 t/ha at the density of 75000 plants/ha.

The use of a higher sowing density, of 75000 plants/ha, under the studied conditions, does not result in getting a greater quantity of DM. Yield increases were higher at the density of 64500 plants/ha, being comprised between 13 and 25%.

The best fertilization rate was of $N_{100}P_{40}$ where they obtained 23.31 t/ha DM at the density of 64500 plants per ha and 20.29 t/ha DM at the density of 75000 plants per ha.

The highest DM yield of 26.11 t/ha was recorded by DR4626 hybrid at the density of 75000 plants/ha in the variant fertilized with $N_{100}P_{40}$.

BIBLIOGRAPHY

1. Boddiger, D., 2007 - *Boosting biofuel crops could threaten food security*. The Lancet, vol. 370, ISSN: 0140-6736, p. 923-924.
2. Crutzen, P. J., A. R. Mosier, K. A. Smith, W. Winiwarter., 2008 - *N_2O release from agro-biofuel production negates global warming reduction by replacing fossil fuels,* Atmos. Chem. Phys., vol. 8, p. 389–395.
3. Torney, F., Lorena Moeller, A. Scarpa, K. Wang, 2007 - *Genetic engineering approaches production from maize,* Current Opinion in Biotechnology, vol. 18, ISSN: 0958-1669, p. 193-199.
4. Thomas, Isabel, 2007 - *The Pros and Cons of Biomass Power*, The Rosen Publishing Group, ISBN: 9781404237421.