THE EFFECT OF ORGANIC-MINERAL FERTILIZATION ON THE YIELD AND QUALITY OF SUGAR BEET IN A LONG TERM EXPERIMENT AT EZĂRENI – IASI

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In the experiments conducted in Ezareni - Iasi during 1986-2006 we observed the influence of Nitrogen fertilization (0-240 kg/ha) on a uniform P and K (P_{96} K_{96}) and of organic fertilizers (manure, straw) on the freshs roots and the dry matter roots and the sugar contents in roots. The fertilization with N determined an important increase of fresh root yield and dry matter. Root yield (dry matter) (the average 1986-2006) had differentiated from 80.8 to 93.3 q/ha on soil background with manure, from 76.2 q/ha to 86.3 q/ha on the soil background with straw and from 68.9 q/ha to 86.4 q/ha in the mineral soil background. The increase in kg roots, dry matter /1 kg N decreased from 27.7 to 10.2 kg in soil background A, from 23.7 kg to 7.2 kg in the soil background B and from 16.2 kg to 7.3 kg/1 kg N, in the soil background NPK, while the nitrogen doses increased from 60 to 240 kg N/ha. The average yield registered during 21 years was: 319-431 q/ha of fresh roots, 68,9-94,6 q/ha of dry matter in roots and 55,0-77,6 q/ha sugar. The biggest values were registered in the manure backgrounds.

***Keywords**: mineral-organic fertilization, yield, quality, sugar.*

Sugar beet gives significant yield increases when it is supplied with sufficient nutrient elements NPK (Kübler E. A. und col., 1982; Bârlea V. and Segărceanu O., 1987; Popescu Ch. and col., 1992; Vasilică C. and col., 1992; Mogârzan Aglaia and col., 1999).

The interaction of the elements NPK favoured increase of yield of roots since 15-16 t/ha and white sugar with 2.79 t/ha (Vasilică C. und Mogârzan Aglaia 1999; Mogârzan, Aglaia and coll. 2000 and 2002).

The fertilization of sugar beet with nitrogen doses biggest than 120-150 kg/ha negative influenced sugar content of roots and roots yield (Mogârzan Aglaia, 1994; Ştefanescu Maria, Ionescu Gh., 1996).

The application of organic and mineral fertilizers upon some sugar beet crops has assured not only an important increase of root yield but it has also determined the preservation of soil fertility (Bora I., 1997; Boguslawski E. V., 1995; Rokasik J. und col., 1997; Bischoff R., 2000, Mogârzan Aglaia, 2004).

The results of experiments presented in these two reports will establish minimum nitrogen doses which assure obtained yield economic increases in conditions of applications organic fertilization without determiner bad less quality.

MATERIAL AND METHOD

The researches were carried out in partnership with Giessen University – Germany and started in 1983, by applying manure at sugar beet.

Were followed two factors:

1. Soil background with three gradations:

A – fertilization with 30 t/ha manure applied for sugar beet;

B – 5 t/ha chapped straw + 50 kg N/ha applied sugar beet + beet leaves, for wheat;

C – without organic fertilization (only mineral fertilization).

2. Nitrogen doses, with five variants; 0, 60, 120, 180 and 240 kg/ha; 96 kg/ha active matter of phosphorus and potassium were buried under the autumn ploughing on the whole experimental plot. The experiment was stationary, in triennial rotation: sugar beet – winter wheat – maize; it was set up in subdivided plots with three repetitions, and a harvesting area of the plot of 35 m^2.

The nitrogen fertilizers were fractionally applied the first applications (60 kg N/ha in variants 2 and 3 and 120 kg N/ha in variants 4 and 5) at sowing; the second application (60 kg/ha in variant 3 and 4 and 120 kg/ha in variant 5) was applied before the third weeding.

The experiment was carried out a cambic chernozem with a medium to high fertility, with a moderate normal content of phosphorus and potassium, with pH values characteristic to poor acid to neutral reaction and loamy – clayey texture.

All the works from the technology of sugar beet were done at optimum level. Statistical processing and interpretation on the results has been done through analysis of variance and correlations method.

In majority of the years (1986-2000) was used method Braşov 519 variety and Alerau of 2001-2003. Before harvesting from each plot, plant samples were taken for different determinations.

Climatic conditions as it is well known, may influence the fertilizer efficiency and the yield level.

Qualifiers were given for each of those 21 years of experimentation, depending on the evolution of the termic regime and especially the rainfall during the vegetation period of the sugar the level of average and maximum grain yield.

Thus we can consider that from these 21 years of experiments were favorable for sugar beet 1986, 1988, 1989, 1990, 1991, 1993, 1999, 2002, 2004, 2005 and 2006, six years (1987, 1992, 1995, 1997, 1998 and 2001) provided that they were not so favorable, three years (1994, 1996 and 2000) with drought and intense heat was been unfavorable to grow for sugar beet in the experiments area and in 2003 with prolonged drought, late winter starting with the end of April month, May and June were total unfavorable for sugar beet, determining the compromises of sugar beet crop in the area.

RESULTS AND DISCUSSIONS

The fresh root yield (the average 1986-2006) registered the following values: 364-428 q/ha in soil background with manure (A), 339-400 q/ha in soil background with chopped straw, and 319-403 q/ha in mineral soil background (*tab. 1*).

Depending on the nitrogen doses applied, the final yield increased up to: 34-112 q/ha roots (10.6-35.1 %).

The fresh roots/1 kg N decreased from 113.3 to 45.4 kg on soil background with manure (A), from 56.7 to 35.0 kg on soil background with mineral fertilization (C), and from 75.0 to 33.7 on soil background with straw, according to the applied dose which increased from 60 kg to 240 kg N/ha.

Table 1

The effect of organo – mineral fertization on the yield of sugar beet in 1986-2006

Variante		Fresh roots yield			Increase kg roots/1 kg N	Dry matter roots yield			Increase kg roots dry matter/1 kg N
	N kg/ha	q/ha	%	dif. q/ha		q/ha	%	dif. q/ha	
A 30 t /ha manure	0	364	114,1	45^{xxx}	-	80,8	117,3	$11,9^{xx}$	-
	60	387	121,3	68^{xxx}	113,3	85,5	124,1	$16,6^{xxx}$	27,7
	120	413	129,5	94^{xxx}	78,3	93,1	135,1	$24,2^{xxx}$	20,2
	180	431	135,1	112^{xxx}	62,2	94,6	137,3	$25,7^{xxx}$	14,3
	240	428	134,2	109^{xxx}	45,4	93,3	135,4	$24,4^{xxx}$	10,2
X_A		405		95,7	74,8	89,4		22,6	18,1
B 5t/kg chaped straw	0	339	106,3	20^{x}	-	76,2	110,6	7,3	-
	60	364	114,1	45^{xxx}	75,0	83,1	120,6	$14,2^{xxx}$	23,7
	120	389	121,9	70^{xxx}	58,3	86,9	126,1	$18,0^{xxx}$	15,0
	180	397	124,4	78^{xxx}	43,3	86,6	125,7	$17,7^{xxx}$	9,8
	240	400	125,4	81^{xxx}	33,7	86,3	125,2	$17,4^{xxx}$	7,2
X_B		378		68,5	52,6	83,8		16,8	13,9
C mineral fertilizers	0	319	100,0	Control	-	68,9	100,0	Control	-
	60	353	110,6	34^{xx}	56,7	78,6	114,1	$9,7^{x}$	16,2
	120	377	118,2	58^{xxx}	48,3	81,6	118,4	$12,7^{xx}$	10,6
	180	404	126,6	85^{xxx}	47,2	86,8	126,0	$17,9^{xxx}$	9,9
	240	403	126,3	84^{xxx}	35,0	86,4	125,4	$17,5^{xxx}$	7,3
X_C		371		65,2	46,8	80,5		14,4	11,0
X		385		76,5	58,1	84,5		17,9	14,3
DL_{ABC}	5%			28,4				6,2	
DL_N	5%			11,6				2,8	
DL_{Inter}	5%			20,0				7,5	

Root yield (dry matter) (the average 1986-2006) had differentiated from 80.8 to 93.3 q/ha on soil background with manure, from 76.2 q/ha to 86.3 q/ha on the soil background with straw and from 68.9 q/ha to 86.4 q/ha (*tab. 1*) in the mineral soil background.

Depending in the nitrogen doses and soil background, significant outputs, statistically ensured, were obtained: 9.7-25.7 q/ha roots dry matter (14.1-37.3 %).

The increase in kg roots, dry matter /1 kg N decreased from 27.7 to 10.2 kg in soil background A, from 23.7 kg to 7.2 kg in the soil background B and from 16.2 kg to 7.3 kg/1 kg N, in the soil background NPK, while the nitrogen doses increased from 60 to 240 kg N/ha.

Sugar content (%) correlates in a great measure with the applied nitrogen doses, registering a decreased sugar percent at the increased doses with nitrogen, especially on organic soil background.

The average value all variants on the organic soil background registered the values of sugar content 18.19-18.27% compared with 17.63 % sugar, the average value of the soil background variants fertilized only with mineral compounds (*fig. 1*).

The average sugar content (%) in accordance with nitrogen doses registered an increase at the variant fertilized with 60 kg N/ha (18.31 %), and a decrease to 17.62 % at the variant fertilized with 240 kg/ha (*fig.2*).

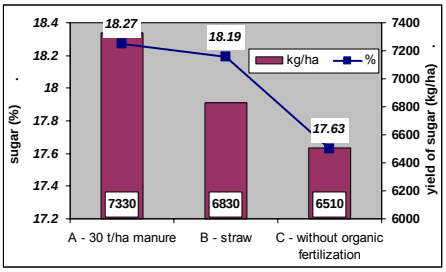

Figure 1. **The effect of soil background on the sugar content and sugar yield in 1986-2006**

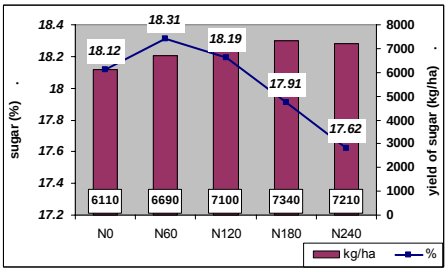

Figure 2. **The effect of nitrogen on the sugar content and sugar yield in 1986-2006**

The highest sugar percentage (18.69 %) was realized by the variant fertilized with 60 kg N/ha on soil background with chopped straw (*fig. 3*)

The sugar yield (kg/ha) differed depending on the fresh root yield and sugar content registered by each variant.

Thus, sugar yield (the average value of 1986 -2006) varied from 6670 kg/ha to 7760 kg/ha in soil background with manure, from 6160 kg/ha to 7130 kg/ha in soil background with straw and from 5500 kg/ha to 7120 kg/ha sugar, obtained by the fertilized soil background, chemically backgrounded only.

The average value of the variants with manure soil background presented the highest value (7330 kg/ha sugar) compared with the average value of the mineral soil background (6510 kg/ha – *fig. 1*).

One notices a slight increase of sugar according with increase of the 180 kg/ha nitrogen doses and the increased nitrogen doses up to 240 kg N/ha determinated a decrease of the sugar yield (*fig. 2*).

In all three soil backgrounds the sugar yield increased somehow proportionally as the nitrogen doses increased up to 180 kg/ha. The highest sugar

yield (7760 kg/ha) was obtained by the variant fertilized with 30 t/ha manure + 180 kg N/ha (*fig. 3*), the same variant which realized the highest root yield.

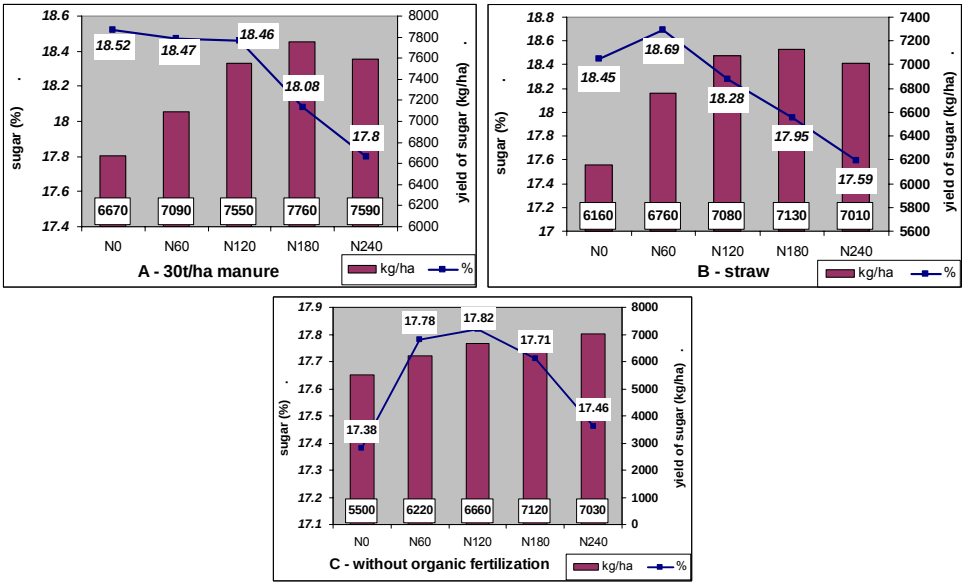

Figure 3. **The effect of organo-mineral fertilization on the sugar content and sugar yield in 1986-2006**

The increase of the nitrogen background unit determined a decrease of the active substances, from the minimum dose (N) up to the maximum nitrogen doses (N_{240}), the highest increase (26.5 kg sugar/1 kg N a. s.) being achieved by the variant fertilized with 60 kg N/ha, on soil background with manure (*fig.4*).

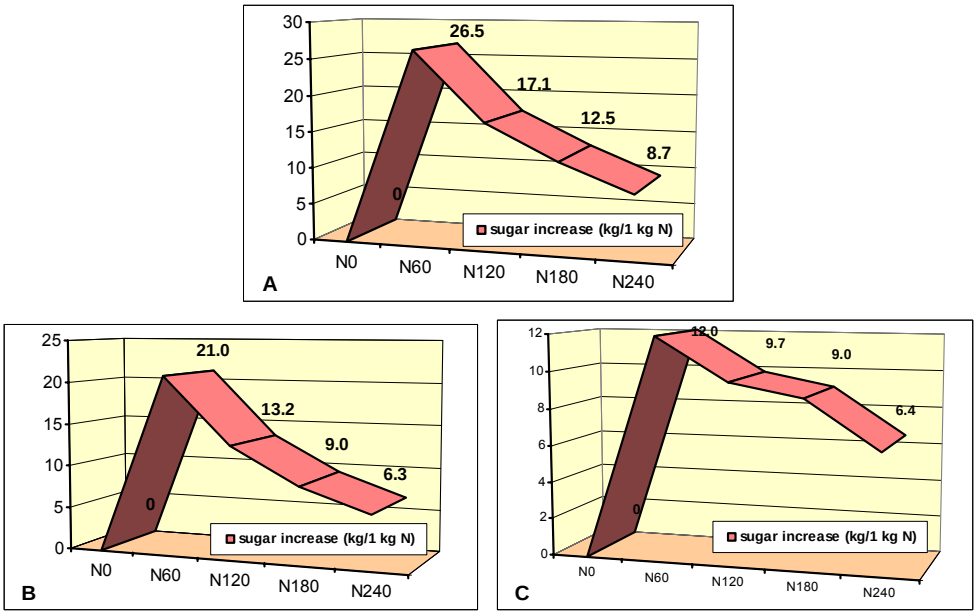

Figure 4. **The effect of nitrogen on the increase of sugar yield**

CONCLUSIONS

1. The fertilization with N determined an important increase of fresh root yield and dry matter.

2. The sugar content of roots registered a decrease according to the increased nitrogen doses, the highest value (18.69 %) being realized by the use of 60 kg N/ha, on the soil background with straw.

3. The sugar beet yield increased as the nitrogen doses increased up to 180 kg N/ha. The increase of nitrogen doses to 240 kg N/ha led to a decreased sugar beet yield.

4. Yields over 7500 kg/ha sugar can be obtained by fertilization with 120-180 kg N/ha + 30 t/ha manure.

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