EFFECT OF FERTILIZING SYSTEMS ON SUGAR BEET YIELD AND QUALITY

UTICAJ SISTEMA ĐUBRENJA NA PRINOS I KVALITET ŠEĆERNE REPE

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Abstract: *Fertilization has a dominant influence in sugar beet production technology. Results of these investigations are achieved at stationary trial on Rimski Šančevi (Novi Sad, Serbia), which was conducted at 1982 on chernozem soil type, subtype on les, and carbonate variety, middle deep form. Organic and mineral fertilizers, with the increased nitrogen doses (from 50-200 kgNha^{-1}) and its effect on the yield and quality of sugar beet were investigated in this trial. At variants where organic fertilizers were used, root yield was higher from 2.4 to 4.6 t/ha^{-1}, but sugar percentage was lower for 0.39%, or it was at the control level. Percentage of sugar utilization was also at the control level or even lower for 0.24 and 1.19%. Sugar beet yield at variants with organic fertilizers was higher for 160, 360 and 510 kg/ha^{-1} in relation to variants were only mineral fertilizers used.*

Izvod: *U tehnologiji proizvodnje šećerne repe đubrenje ima dominantan uticaj. Rezultati ovih istraživanja ostvareni su na stacionarnom ogledu na Rimskim Šančevima, koji je zasnovan 1982. godine, na zemljištu tipa černozem, podtip na lesu, varijetet karbonatni, forma srednje dubok. U ogledu je ispitivan uticaj organskih i mineralnih đubriva, sa rastućim količinama azota (od 50-200 kgNha^{-1}) na prinos i kvalitet šećerne repe. Na varijantama sa organskim đubrivima prinos korena bio je veći od 2,4 do 4,6 tha^{-1}, a procenat šećera niži za 0,39 % ili na nivou kontrole. Procenat iskorišćenja šećera takođe je bio na nivou kontrolne varijante ili manji za 0,24 i 1,19 %. Prinos šećera na varijantama sa organskim đubrivima u odnosu na mineralna bio je veći za 160, 360 i 510 kgha^{-1}.*

Key words: *sugar beet, yield, quality, fertilization*
Ključne reči: *šećerna repa, prinos, kvalitet, đubrenje*

INTRODUCTION

Sugar beet has much more specific production then the other cultivated plants.

Fertilization, in sugar beet production, has the most important influence at physical soil properties, and at root yield and technological quality (sugar yield).

To achieve these goals it is necessary to apply optimal combinations of organic and mineral fertilisers. Beside the fertilization, the rest of cultural practice has important influence at root yield. For the higher and stabile yield full attention must be paid to every stage of cultural practice. Among equally important measures, fertilization is slightly important measure.

MATERIAL AND METHOD

Investigations were done at long time stationary trial at Rimski Sancevi, Novi Sad, Serbia. The trial was conducted in 1982 year, and it belongs to system of field trials which where investigated in eight Europe countries. In this trial different organic and mineral fertilisers were investigated. The trial was in four-field crop rotation (sugar beet, winter wheat,

maize, barley). Trial conduction was done by split-plot method, where the factor A was the type of fertiliser: only mineral fertilisers, manure + mineral fertilisers, harvest pre crop residues + mineral fertilisers, harvest residues + mineral fertilisers + liquid manure. Factor B were nitrogen amounts: Ø, 50, 100, 150, and 200 kgNha^{-1}. Soil on which the trial was conducted was chernozem soil type, sub type on les, carbonate form and deep variety. Physical, chemical and microbiological properties of this soil type are good.

Soil tillage for sugar beet was done by principle of "recovering plough" (by Todorović). The Sara cultivar was the subject of these investigations, and in this paper work would be presented the average results during the years 1992, 1993, 1994, and 1995. (4 years). Sugar beer sowing dates during these years were in optimal time. The rest of the cultural practices were conducted in the optimal time as well. At the end of vegetation the next analyses were done: root yield was measured as well as the above ground part yield, sugar content, amounts of harmful K, Na, α-amino N, sugar utilization percentage and sugar yield.

In this paper we present the results of root yield, sugar amounts, sugar utilization percentage (in a function of quality) and sugar yield. All of these elements were proceed statistically.

RESULTS AND DISCUSSION

Sugar beet root yield is shown in Table 1.

Table 1

Root yield (tha^{-1})

Variants	N-*doses* (kgha^{-1})					*Average*
	Ø	50	100	150	200	
M.F.	23.40	31.24	36.60	38.94	36.03	33.24
M.	33.18	36.37	37.68	40.61	40.72	37.71
H.R.	26.23	36.09	37.26	41.51	37.19	35.66
H.R. + L.M.	32.89	39.04	38.33	38.57	40.22	37.81
Average	28.93	35.69	37.47	39.91	38.54	-
LSD		A	B	B Δ A	A Δ B	
	0,01	2.62	2.48	4.90	4.95	
	0,05	1.73	1.84	3.56	3.68	

M.F. = Mineral Fertilizers *M.* = Manure
H.R. = Harvest Residue *H.R.. +L.M. = Harvest Residue + Liquid Manure*

Significantly lower yield was achieved at variant with only mineral fertilisers regarding to variants where organic fertilisers were applied. Among the organic fertilisers the lower yield was at variant with harvest residues, and difference was statistically significant. The difference between the other two fertilization variants was not significant. At all investigated variants the lower root yield was at variant without nitrogen. Using the mineral fertilisers only, the yield was increased to 150 kgNha^{-1}, but increasing was significant to 100 kgNha^{-1}. The other differences were not significant. Yield increasing with nitrogen and manure was to 150 kgNha^{-1}. The differences between 50 and 150 kgNha^{-1} were significant. The differences between 100 and 150 kgNha^{-1}, and 150 and 200 kgNha^{-1} were not significant. The highest root yield in this trial was achieved with 150 kgNha^{-1} at variant with harvest residues. The difference was statistically significant referring to 50 and 100 kgNha^{-1} and control. The other differences were not significant. At variant where were applied harvest residues and liquid manure 50 kgNha^{-1} was enough for high yield. The differences between the other variants of fertilizations with nitrogen were not significant.

Sugar content is shown in Table 2 (%).

Table 2

Sugar content (%)

Variants	N-*doses* (kgha^{-1})					*Average*
	Ø	50	100	150	200	
M.F.	15.47	15.72	14.58	15.15	14.75	15.13
M.	16.47	14.63	13.89	14.41	14.31	14.74
H.R.	15.62	16.48	14.84	15.06	15.44	15.49
H.R. + L.M.	17.03	15.54	14.58	14.66	14.69	15.30
Average	16.15	15.59	14.47	14.82	14.80	-
LSD		A	B	B Δ A	A Δ B	
	0.01	0.81	0.73	1.46	1.46	
	0.05	0.54	0.54	1.06	1.08	

M.F. = Mineral Fertilizers *M. = Manure*
H.R. = Harvest Residue *H.R.+L.M. = Harvest Residue + Liquid Manure*

Using fertilization with mineral fertilisers only, sugar content was significantly lower at nitrogen variants higher than 50 kgNha^{-1}. The other differences were not statistically significant. On variant with manure applying, sugar percentage was significantly decreased by applying nitrogen, and between nitrogen variants were not significant differences. With harvest residues it was enough to use 50 kgNha^{-1} for statistically higher sugar percentage referring to all variants except control variant (without nitrogen) and variant with 200 kgNha^{-1}. In the average, the smallest sugar percentage was at variant with manure only, and statistically significant difference was only in relation to the other two variants with organic fertilisers.

Percentage of sugar utilization as the result of sugar beet root quality (K, Na, α-amino N and sugar percentage) is shown in table 3.

Table 3

Utilized sugar content (%)

Variants	N-*doses* (kgha^{-1})					*Average*
	Ø	50	100	150	200	
M.F.	13.11	13.09	11.45	11.83	11.23	12.14
M.	13.31	11.08	9.78	10.26	10.32	10.95
H.R.	13.10	13.45	11.11	11.56	11.76	12.20
H.R. + L.M.	14.38	12.27	10.86	11.21	10.77	11.90
Average	13.48	12.47	10.80	11.21	11.02	-
LSD		A	B	B Δ A	A Δ B	
	0.01	0.95	0.88	1.75	1.76	
	0.05	0.63	0.66	1.27	1.31	

M.F. = Mineral Fertilizers *M. = Manure*
H.R. = Harvest Residue *H.R.+L.M. = Harvest Residue + Liquid Manure*

The highest percentage of sugar utilization was at variant without nitrogen (control), at the all variants with organic and mineral fertilisers. With applying of more than 50 kgNha^{-1} sugar utilization was smaller at mineral fertilisers variant and at the variant with harvest residues. Between the other variants fertilized with nitrogen the difference was not statistically significant. Sugar utilization at variants with manure was significantly smaller at all nitrogen variants, but between these variants there was no significantly difference. With applying of harvest residues, liquid manure and nitrogen, sugar utilization was decreasing to 100 kgNha^{-1}. Latest differences were not significant.

Sugar yield as the result of sugar beet rot yield and quality is shown in Table 4.

Table 4

Sugar yield ($kgha^{-1}$)

Variants	*N kgha^{-1}*					*Average*
	Ø	50	100	150	200	
M.F.	3.19	4.15	4.33	4.83	4.23	4.15
M.	4.58	4.34	3.84	4.46	4.32	4.31
H.R.	3.37	5.10	4.42	5.06	4.58	4.51
H.R. + L.M.	4.93	5.05	4.53	4.42	4.39	4.66
Average	4.02	4.66	4.28	4.69	4.38	-
LSD		A	B	B Δ A	A Δ B	
	0.01	0.55	0.49	0.98	0.98	
	0.05	0.36	0.37	0.71	0.73	

M.F. = Mineral Fertilizers *M. = Manure*
H.R. = Harvest Residue *H.R.+L.M. = Harvest Residue + Liquid Manure*

CONCLUSIONS

- Experimental research showed following results:
- The root yield increasing was significantly till 100 $kgNha^{-1}$ at variants with mineral fertilisers, harvest residues and till 50 $kgNha^{-1}$ at manure variant and harvest residues + liquid manure variant.
- Sugar percentage and sugar utilization percentage were significantly higher at control variant and with 50 $kgNha^{-1}$ at variants with mineral fertilisers and harvest residues. At the other two variants (manure and harvest residues + liquid manure) at the control variant were the highest sugar percentage and sugar utilization.
- The highest sugar yield was at the variants with mineral fertilisers, harvest residues and 50 $kgNha^{-1}$.
- At the other two variants (manure and harvest residues + liquid manure) the highest sugar yield was at variant without the nitrogen.

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