RESEARCH REGARDING THE DYNAMIC ACCUMULATION OF SUGAR TO THE SWEET SORGHUM CULTIVATED IN OLTENIA (ROMANIA)

CERCETĂRI PRIVIND ACUMULAREA ÎN DINAMICĂ A GLUCIDELOR LA SORGUL ZAHARAT CULTIVAT ÎN OLTENIA (ROMANIA)

Gh. MATEI, M. NICOLESCU

University of Craiova, Romania
Corresponding author: GH. MATEI, E-mail: matei.gheorghe@gmail.com

Abstract: *In this paper we present the dynamics of accumulation of the sugar in the sweet sorghum stalks cultivated in non irrigated conditions on the brown-reddish soil from central area of Oltenia. The analyses were done in the main stage of the plant development. The highest level of refractometric sugar was registered in the milk maturity stage of plant development on the internodes from the median area of the plants.*

Rezumat: *În lucrarea de față se prezintă acumularea în dinamică a glucidelor în tulpinile de sorg zaharat cultivat în condiții de neirigare pe solul brun-roşcat din zona centrală a Olteniei. Determinările au urmărit acumularea de zahăr refractometric în tulpini în principalele fenofaze de vegetație a sorgului zaharat. Conținutul maxim a fost înregistrat la maturitatea în lapte a plantelor la nivelul internodurilor din zona mediană a plantei.*

Key words*: sweet sorghum, stalks, sugar*
Cuvinte cheie*: sorg zaharat, tulpini, zahăr*

INTRODUCTION

The sweet sorghum is used in the alimentary, industrial and animal feeds fields. From the sweet sorghum stalks we extract a sweet juice which is used to produce alcohol, ethanol, or in animal feed applied to the brutish fodder.

The content of sugar in this juice is influenced by the genetically material used and the culture crop conditions. The level of refractometric sugar at the sweet sorghum cultivated in Romania varied between 16% and 22% (I. Antohi et al.)

MATERIAL AND METHOD

The research was carried out at SCDA Simnic Craiova during the 2001 – 2004 years cultivated in non irrigated conditions on the brown reddish soil with 5.8 pH and medium reach in nitrogen, phosphorus and potassium.

As genetically material we use 3 hybrids of sweet sorghum: Doina, F112 and Roza and one variety Carmen. The plant's density used was 120000/ha.

The area of one variant was 42 m^2.

The date of sowing in every year was situated in the first pentad of the May and the date of harvesting was situated in the interval 1 – 10 of October.

The determinations were done in the experimental field with the Zeiss refractometer in the different stage of plant development. The sweet sorghum crop has as previous culture the winter wheat.

As a standard we use F112 hybrid.

RESULTS AND DISCUSSIONS

The dynamics of sugar gathering in the sweet sorghum stalks was observed during the

whole period of vegetation of sweet sorghum and was determined in the main stages of development of the plants, which are: prebladder, bladder, in bloom, milk maturity and physiological maturity.

The level of accumulated sugar was determinate at the level of stalks internodes. This was determinate in the field by using the refractometring device. The stalk internodes at the bottom of the plants (I_b) were analyzed - the internodes segments 3, as well as from the middle of the plant (I_m) - the internodes segments 5-7 and from the top of the plant (I_t) - the internodes segments 9-11.

Table 1

The refractometric sugar determined in the main stages of development plant (2001 -2004)

No.	Hybrid	Development stage	Refractometric sugar - %			Av/plant % sugar	Grams sugar/100 ml juice
			I_b	I_m	I_t		
1	Carmen	prebladder	6.1	6.9	6.6	6.5	5.39
		bladder	7.6	10.0	9.4	9.0	7.47
		in bloom	14.1	15.4	15.1	14.8	12.28
		milk maturity	18.2	19.0	18.5	18.5	15.35
		ph. maturity	17.0	18.3	17.8	17.7	14.69
2	Doina	prebladder	8.0	8.5	8.2	8.2	6.80
		bladder	8.6	11.2	10.4	10.0	8.30
		in bloom	12.1	14.1	14.0	13.4	11.12
		milk maturity	15.8	18.1	17.0	16.9	14.02
		ph. maturity	15.4	16.8	16.9	16.3	13.52
3	F112	prebladder	6.6	7.4	7.1	7.0	5.81
		bladder	7.4	11.0	8.5	8.9	7.38
		in bloom	10.7	12.7	13.2	12.2	10.12
		milk maturity	15.2	16.1	16.1	15.8	13.11
		ph. maturity	14.7	16.0	15.2	15.3	12.69
4	Roza	prebladder	8.5	9.8	9.1	9.1	7.55
		bladder	9.5	13.0	12.1	11.5	9.54
		in bloom	12.9	14.0	14.3	13.7	11.37
		milk maturity	17.0	18.3	18.0	17.7	14.69
		ph. maturity	16.2	17.5	16.2	16.6	13.77

As we can see in the table no. 1, the sugar begins to get accumulated in the plant at the very beginning of the vegetation period. The sugar level is quite high beginning with the period of prebladder, varying between 6.5% for Carmen variety and 9.1% for Roza hybrid, the later of which has got of faster growing rhythm and a more maturity.

The highest value belongs to Carmen variety – 18.5%, that means a value of 15.35 grams of sugar/100 ml juice. The lowest value belongs to F112 hybrid – 15.8%, that means 13.11 grams of sugar/100 ml juice.

The accumulation of the sweet substances in the plant varies at the stalk internodes, the highest value of sugars was determined at the internodes 5 - 7, while the lowest level was determined at the bottom of the plant - the internodes 2 and 3.

The stalks internodes 9 - 11 realized values lower than those determined in the middle of plant, but higher than those determined at the bottom of the plant.

If we observe the influence of the genetically material used in experiments**,** we can see that all the experimented hybrids exceeded the standard - the F112 hybrid, being obviously higher than this (Table no.2).

Table 2

The influence of hybrid to the sugar accumulation
in sweet sorghum stalks
(2001 -2004)

No	Variety Hybrid	Grams sugar/ 100ml juice	Difference grams	%	Signification
1	Carmen	11.03	+1.21	112.3	**
2	Doina	10.75	+0.93	109.4	*
3	F112	9.82	Standard	100.0	Standard
4	Roza	11.39	+1.57	115.9	***

DL 5% = 0.906 grams
DL 1% = 1.142 grams
DL 0.1% = 1.550 grams

Related to the standard, only the Roza hybrid realized a very significant increase of level of sugar/100 ml juice of 11.39 grams/100 ml juice with a plus of 1.57 grams/100 ml juice. In comparison with the F112 value, which realized 9.82 grams/100 ml juice, the Carmen variety has exceeded that level with 1.21 grams/100 ml juice, which means a distinct significant increase.

The Doina hybrid realized 10.75 grams/100 ml juice of sugar accumulation in stalks, with significant difference of 0.93 grams/100 ml juice related the used standard.

The main stage of plant development has powerful influenced the level of sugar accumulation into sweet sorghum stalks. As it can be seen in table no 3 the level of sugar begins to increase from the early stage of preblader to the final stage of physiological maturity.

Related to the first stage (6.39 grams/100 ml juice) in which we done the analysis (as whiteness) it can be observed that the level of sugar becomes higher from stage to stage until the plants were in the milk maturity stage, when is registered the highest level of sugar in sweet sorghum stalks (14.29 grams/100 ml juice, that means an increase of 123.6%).

After this point the level of sugar from the stalks is begin to decrease and in the final stage of physiological maturity we registered a value as average of 13.67 grams/100 ml juice (a plus of 113.9%).

Table 3

The influence of the development stage of plant to the accumulation of sugar in sweet sorghum stalks *(2001 -2004)*

No.	Stage of plant development	Grams sugar/ 100ml juice	Difference grams	%	Signification
1	prebladder	6.39	Mt	100.0	Mt
2	bladder	8.17	+1.78	127.8	**
3	in bloom	11.22	+4.83	175.5	***
4	milk maturity	14.29	+7.90	223.6	***
5	ph. maturity	13.67	+7.28	213.9	***

DL 5% = 0.921 grams sugar/100 ml juice
DL 1% = 1.836 grams sugar/100 ml juice
DL 0.1% = 3.463 grams sugar/100 ml juice

CONCLUSIONS

From the presented data we can say that:

- The sugar begins to accumulate into sweet sorghum stalks from early stage of plant development;
- The level of sugar is highest at the level of the middle internodes of the plant;
- The highest level of sugar in stalks was registered at the Roza hybrid with a value of 11.39 grams/100 ml juice followed by the Carmen variety with 11.03 grams/100 ml juice;
- The sugar level from stalks increase until the milk maturity stage (14.29 grams/100 ml juice) and after that point decrease to the physiological maturity (13.67 grams/100 ml. juice)

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