

INCREASED NUTRITION AREA AS A MODIFYING FACTOR OF FENOTYPICAL SHOW OF SUGAR CONTENT OF MS LINES AND FIXING AGENTS OF STERILITY IN SUGAR BEET

The article shows the results of the research of the influence of increased nutrition area on sugar content and sugar crop in MS lines and sterility fixing lines of sugar beet. It is determined specific reaction of genotypes to modifying factor, its most essential influence on characteristics variability, most perspective materials for formation of simple sterile hybrids as mother components have been chosen.

Keywords: *increased nutrition area, sugar content, sugar crop, divergence from the average, divergence from the standard, genotype- environment interaction*

Introduction. Genotype of sugar beet plants is realized in determined conditions of the environment, thus the level of heterozygotes acts a role in genotype – environment interactions. Population materials which are heterozygotic

show higher stability to influence of biotic and abiotic factors of environment in comparison with homozygotic lines. However all methods used for study of genotype of breeding materials demonstrate the fact, that they are directed for study of action and interaction of genes which control development and characteristics show under definite conditions of the environment.

Some home scientists have conclude, that crossing of lines with high level of inbreeding with heterozygotic testers brings to creation of more heterozygotes in comparison with crossing of populations, thus there is more occurrence of superdomination. It is the real evidence of different genetic origin of general and special combination ability [2]. Since homogenic lines often have lower economically valuable characteristics than population ones, but their show depends not only on genotype but also on agronomical methods which modify their genotype.

To study special reactions of genotypes on the conditions of environment we can use not only uncontrolled ecological factors, but also agronomical background- different fore-runners, various dozes of mineral nutrition, different soils etc. But as A.A.Mazlumov have concluded, increased nutrition area more powerfully impacts variability of valuable characteristics of sugar beet [3].

The aim of our research was to determine modifying influence of increased nutrition area on the show of sugar content in MS lines and sterility fixing lines, and to see their different reaction to this factor.

Materials and methods. We carried out our researches in Verkhnyachka research-breeding station (VRBS) during 2010-2012 years. There have been used 5 pollen-sterile (MS lines) and 5 sterility fixing lines (SF) as components of simple sterile hybrids, which further in time were studied for sugar content in normal (control) plot (22,5×45 cm), and with increased nutrition area (45×45 cm). Variants of nutrition area were formed during the process of formation of the plant density. After mechanical formation of normal plots by hand we leaved two extreme plants, and to get increased plots (45×45) we leaved only one central plant in the plot. The tests were carried out according to usual methods [4]. Location of the plots in the experiment was randomized. Sugar content was determined in the automatic line «Venema» [5].

Experimental data and dispersive analysis were made according to the method of B.O. Dospechov [6]. Divergence of sugar content we have calculated in comparison with average

population data (in absolute and relative values), and also with group standard (three hybrids of home and foreign breeding).

Results and discussion. Such different reactions of breeding materials on the increased nutrition area are possible: 1) lower value of the characteristic, 2) weak reaction to the impact of the modifying factors, change of the characteristic is in the zone of statistical error, and 3) positive influence, absolute values of influence are essentially higher than in control ones. In multifactor experiment on MS hybrids carried out by S.V. Katanenko during 90-th years of the last century it was determined, that variability of sugar content on 62,3 % depends on modifying factors such as mostly the length of vegetation period and less genotypic variety of hybrids (8,9%), and at last for 24,5% it depends on the ability of genotypes to interact with environmental factors [7]. Our data show that the main impact was increased nutrition area (IA) for MS about 59%, the impact of genotype we have estimated as 25,7%, and the interaction of genotype with the factor of increased nutrition area (IA) was 16% (*figure 1*).

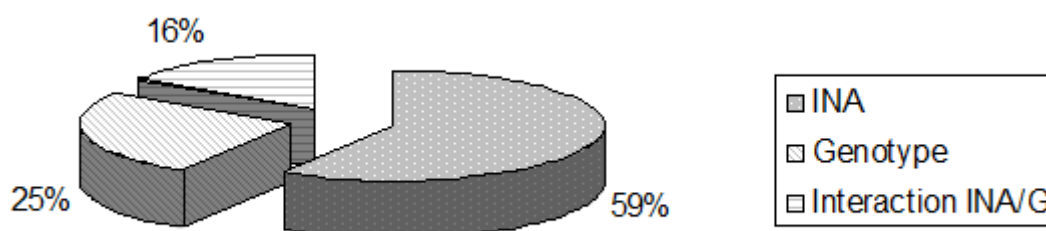


Fig. 1. Sources of variation of sugar content of MS lines of sugar beet, VRBS, 2010-2012

The same data was obtained also for sterility fixing lines: RP – 55,5%, genotypes – 25,5 %, and the interaction of these two factors 21% (*figure 2*).

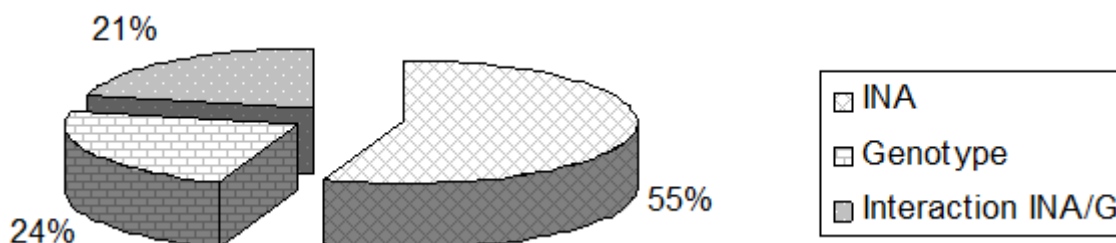


Fig. 2. Sources of variation of sugar content of sterility fixing lines of sugar beet, VRBS, 2010-2012

Absolute values of sugar content in control and increased nutrition area in MS lines and SF lines, and their comparison with average population values and standard are shown in the table.

Analysis of the table data shows specific reaction of genotype (in lines level) to the influence of the modifying factor – increased nutrition area. Different reaction of genotypes on hybrid level was depicted by other authors [7, 8]. Thus, two MS lines (MS1 and MS 3) showed lower sugar content, MS 2 line –higher sugar content, and MS line 4 and MS line 5 did not change this characteristic essentially (in the rank of statistic error). MS line 2 had got the highest sugar content (17,7%) on normal nutrition area, and this value was the highest between all lines on the increased area (18,1%), this data is essentially higher than average population and standard in both variants: 5,2% and 7,3% accordingly. Thus, this line is stable in high level of sugar content in different agronomical conditions. Between the sterility fixing lines OT 3 essentially lowered sugar content, two lines showed the same values (OT2 and OT4), and lines OT 1 and OT 5 demonstrated higher by 1 % value (absolute value), which is essentially higher than average population value.

Values of sugar crop depend not only on sugar content but also on crop capacity of the lines. It is obvious that all MS lines had higher sugar crop in increased nutrition area. Sterility fixing lines

OT 1 and OT 2 also have demonstrated higher values of sugar crop, OT 3 line – lower, and OT 4 and OT 5 did not changed the values (*figure 3*). It is explained by the correlation between sugar crop and sugar content which depends on genotypic characteristics of the breeding materials [9].

Table 1

Sugar content in MS lines and SF lines depending on different nutrition area, 2010-2013

Bree-ding material	Control (NNA)			INA		
	%	divergence from the average	divergence from the standard	%	divergence from the average	divergence from the standard
MS lines						
ЧC 1	16,5	-0,4	-1,8	16,2	-0,6*	-4,1
ЧC 2	17,7	0,8*	5,2*	18,1	1,3*	7,3*
ЧC 3	17,0	0,1	1,2	16,6	-0,3	-2,0
ЧC 4	16,6	-0,3	-1,2	16,4	-0,4*	-3,0
ЧC 5	16,8	-0,1	0	16,9	16,9	0
LSD _{0,05}	0,4			0,3		
SF lines						
OT 1	15,4	-1,2*	-8,2	16,4	0,6*	-7,9
OT 2	17,0	0,4	1,6	17,0	0,1	-4,3
OT 3	17,3	0,7*	3,2	16,8	-0,1	-5,4
OT 4	16,5	-0,1	-1,7	16,8	-0,1	-5,4
OT 5	16,8	0,2	0	17,8	0,8*	0
LSD _{0,05}	0,3			0,4		

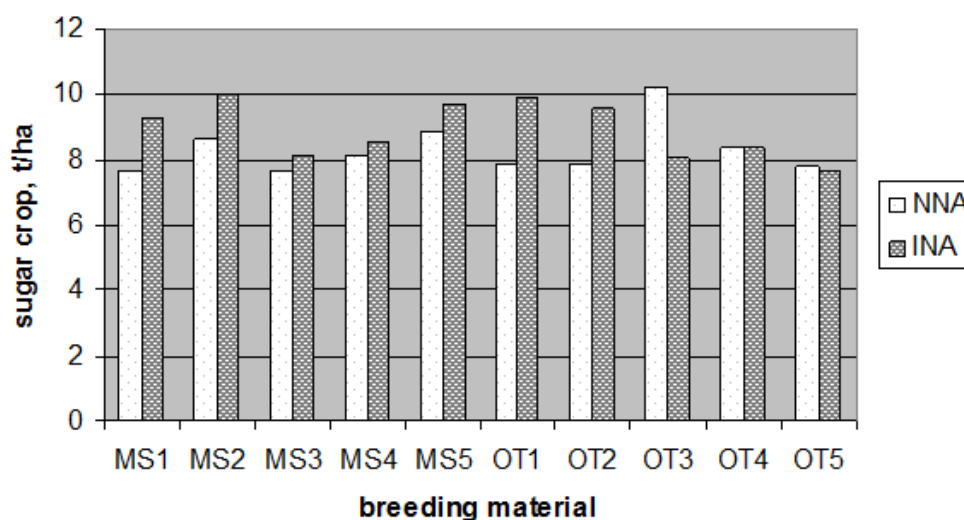


Fig. 3. Sugar crop of MS lines and SF lines accordingly to nutrition area

The sources of sugar content in MS lines sterility fixing lines are the same, and the most essential of the factors is increased nutrition area (50 and 55%) and interaction with the environment (24 and 25%) with real influence of genotype of the tested forms (16 and 21 %).

Conclusions. MS lines and SF lines of sugar beet are characterized by special reaction of genotypes to increased nutrition area by the value of sugar content and sugar crop. Breeding material – components of simple sterile hybrids – we studied with the aim of getting pairs for mother components of hybrids which are different in their reaction to the modifying factor, we have chosen lines with positive and stable reaction (MS2, OT1 and OT5) to the changes of agronomical conditions.

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Аннотация

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Расширенная площадь питания как модифицирующий фактор фенотипического проявления сахаристости МС линий и закрепителей стерильности сахарной свеклы

В статье исследовано влияние фактора расширена площадь питания на проявление сахаристости и сбора сахара в МС линий и закрепителей стерильности сахарной свеклы. Установлена специфичность реакции генотипа на модифицирующий фактор, его преобладающее влияние на вариацию признаков, выделены перспективные материалы для формирования простых стерильных гибридов как материнских компонентов.

Ключевые слова: расширенная площадь питания, сахаристость, сбор сахара, отклонение от средней, отклонение от стандарта, взаимодействие генотип-среда

Анотація

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Розширена площа живлення як модифікуючий фактор фенотипового прояву цукристості ЧС ліній і закріплювачів стерильності цукрових буряків

В статті досліджено вплив фактору розширена площа живлення на прояв цукристості і збору цукру у ЧС ліній і закріплювачів стерильності цукрових буряків. Встановлено специфічність реакції генотипу на модифікуючий чинник, його переважаючий вплив на варіювання ознак, виділено перспективні матеріали для формування простих стерильних гібридів як материнських компонентів

Ключові слова: розширена площа живлення, цукристість, збір цукру, відхилення від середньої, відхилення від стандарту, взаємодія генотип-середовище