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INTERRELATION OF SEED SIZE AND SUGAR BEET PRODUCTIVITY

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Similarity, root borer lesions, the initial growth, the dynamics of root mass and productivity of sugar beet depending on the fraction of seeds are investigated. It is proved that plants grown from seeds of fraction 5.5 - 4.5 mm had higher yields and sugar gathering compared to seeds of size 4.5 - 3.5 mm.

As observed in most of literary sources published before 1990, beet sugar gives a better yield from the larger diameter of glomeruli. Gruner M.N., Orlovskyi M.I., Zadler V.V., Uran I. have concluded that larger glomeruli of polyspermous beet sugar have actually larger seed. It has more reserve substances, provides the strongest seedling, grows faster and eventually we get bigger harvest of root crops [1]. These results O.K. Kolomiets confirmed working with one seed beet sugar [2, 3].

Since 1990, somewhat earlier researches have appeared in which small fraction of seeds 3.5 - 4.5 mm in diameter for the vigor and laboratory germination is equal to or is better than large fraction. Therefore, to increase the multiplication factor it is recommended in seed crops of MS component to use fraction of 3.0 - 3.75 mm. [4]. It is noted that in productivity seed fraction of 3.5 - 4.5 mm gives the best results compared to the fraction of 3.25 - 3.5 mm, and a large fraction of 4.5 - 5.5 mm is not considered [5]. Issue of importance of fraction 3.5 - 4.5 mm stems from the fact that when growing seeds of modern hybrids based on ЦЧС 56 - 64% of the seed fraction and only 25 - 26% of large fraction - 4.5 - 5.5 mm are received [6 7]. Several authors, seed experts also argue that seed fractions of 3.25 - 3.75 mm are not worse for sowing qualities than a large fraction, but the productivity is not discussed [8, 9].

Methods and materials. We studied the productivity of sugar beet depending on the fraction of seeds. For research we selected seeds of its various forms (F1 – hybrids, MS – Male Sterile Lines, O-types – fixers of sterility). Seeds in diameter were divided into two fractions - 4.5 - 5.5 and 3.5 - 4.5 mm, which by mass was 20 to 29% lower.

Seeds were plated by a selective seeder in a threefold repetition. The current density and caring for crops during the growing season corresponded recommendations for this area.

Laboratory germination was determined by the requirements of state standard, field germination – according to the methodological requirements. During the growing season we spent observations on the dynamics of growth of weight and sugar content of roots. Evaluation of yield and sugar content was performed by the

method of pre-strain testing, roots were weighed from each plot in the field and the sugar content was determined by cold digestion on the line “Venema”.

The research results and their discussion.

Terms of vegetation were close to the average perennial ones, with some differences in the years of research. In 2008 early development of spring processes and adequate heating of the soil allowed to carry out the sowing of sugar beet on April 10. The soil was well warmed up (at a depth of 10 cm - 9 - 10 ° C) and humidified. Shoots appeared in 12 days, the formation of the leaves started from the beginning and root growth since the third decade of May. In June and July the conditions for root growth were favorable. They became complicated in August with the beginning of hot dry weather, the soil quickly dried up, and growth slowed sharply.

Early spring in 2009 allowed sowing beets on April 6 in well-heated and moderately humidified ground. Shoots appeared on May 20, root crop growth started from the third decade of May. Condition of crops during the growing season was good and root crop increase in July was greater than in the previous year. Roots were collected on September 19 (technical maturity). Reducing the length of the growing season resulted in lower yields compared to 2008.

In 2010 there was a late start of spring processes with active heat increase. Sugar beet was sown on April 20 on condition of satisfactory wetting of seed containing soil layer. Beet shoots of larger seed took 13 days, or two days later by a smaller fraction. The growth of root crops of sugar beet began in early June, during which the plants closed aisle. To the second half of July the crop condition was good, but with the beginning of hot, rainfall-deficient weather, further conditions for the growth of root crops deteriorated.

As over the years the significant differences of studied parameters were not observed, we result the average data of 2008 – 2010. In field conditions a large fraction of seeds had slightly lower rates of similarity with respect to the smaller fraction, although in laboratory conditions germination varied within the error of the experiment (Table 1). This can be explained by the fact that the germination of a large fraction (4.5 - 5.5 mm) more water is required, and in the spring moisture deficiency small (3.5 - 4.5 mm) fraction of sugar beet seeds provides better shoots, the difference was in the range of 2 to 5 percent. It has been the lowest in hybrid seed and grew in the direction of fixatives of sterility to Male Sterile Lines. Weight of 100 seedlings for 15 day after germination, in phase of two true leaves was greater in plants obtained from a large fraction of seeds ranged from 28.7 to 36.9 g versus 22.3 – 32.4 g of a small fraction. Towards reducing the difference forms ranged in the following order: fixers of sterility, Male Sterile Lines, Male Sterile hybrid.

Root borer lesions were lower in crops of a large fraction ranged from 4.5 to17, 1%, versus 14.2 – 18.7% in a small fraction. According to the average data for all three studied forms larger one by 3.7% and inferior to 7.1 and 5.2%, respectively dominated smaller fraction respectively by mass of 100 seedlings and resistance to root borer.

1. Characteristic of sown properties of seeds of sugar beet for 2008–2010

Field number	Fraction, mm	Germination, %		Weight of 100 seedlings, g	Root borer lesions, %
		laboratory	field		
201 F_1	4,5 – 5,5	86,4	58,3	36,6	12,5
202 F_1	3,5 – 4,5	85,9	60,1	32,4	18,7
203 $ЧС_1$	4,5 – 5,5	85,7	61,6	28,7	7,6
204 $ЧС_1$	3,5 – 4,5	86,8	64,7	24,9	14,2
206 $ЧС_2$	4,5 – 5,5	84,7	53,9	32,5	4,5
205 $ЧС_2$	3,5 – 4,5	83,9	57,7	28,3	14,5
208 $От_1$	4,5 – 5,5	88,1	53	36,1	6,5
207 $От_1$	3,5 – 4,5	84,9	57	28,8	16,4
210 $От_2$	4,5 – 5,5	85,7	48,6	36,9	17,1
209 $От_2$	3,5 – 4,5	85,2	52,3	28,2	17,3
215 $ЧС_3$	4,5 – 5,5	87,4	69,9	32,4	6,1
214 $ЧС_3$	3,5 – 4,5	85,8	74,2	22,3	16,5
181 $ЧС_4$	4,5 – 5,5	87,2	54,3	36,1	8,8
216 $ЧС_4$	3,5 – 4,5	86,1	59,3	24,7	15,5
Середнє	4,5 – 5,5	86,5	57,1	34,2	9,0
Середнє	3,5 – 4,5	85,5	60,8	27,1	14,2
$НІР_{05}$		4,8	3,3	3,9	

The results of determination of the dynamics of growth of root crop weight and sugar content are summarized in Table. 2. Better plant growth trend persists for a large fraction of 4.5 - 5.5 mm. Plants of this fraction throughout the growing season better enlarged the mass of root crops, keeping the sugar content at the secondary level.

Root vegetables derived from a large fraction of seeds, in July grew by 176 grams, in August – 105 g, and with small fraction over the period, respectively, 151 and 98 g. The greatest mass of root crops was formed in Male Sterile hybrid, fixers of sterility and Male Sterile Lines did not have significant differences.

By sugar content studied forms of sugar beet practically were not different.

Dynamics of growth of root crop mass in grams and sugar content as a percentage of sugar beet, average of three years

Field number	Fraction, mm	The beginning of the first decade of					
		July		August		September	
		weight	sugar content	weight	sugar content	weight	sugar content
201 F_1	4,5 – 5,5	164	10,7	392	17	506	18,8
202 F_1	3,5 – 4,5	148	11	356	16,3	457	18,5
203 $ЧС_1$	4,5 – 5,5	119	10,1	306	15,6	428	18,2
204 $ЧС_1$	3,5 – 4,5	115	10,6	256	16,5	371	18,6
206 $ЧС_2$	4,5 – 5,5	148	9,9	297	17	411	16,9
205 $ЧС_2$	3,5 – 4,5	129	11,3	235	16,1	332	17,8

208 От$_1$	4,5 – 5,5	160	11,2	321	15,8	413	20,6
207 От$_1$	3,5 – 4,5	130	10,9	279	16,9	371	19,6
210 От$_2$	4,5 – 5,5	141	10,5	337	16,5	415	18,6
209 От$_2$	3,5 – 4,5	130	11,1	318	15,3	379	20,2
215 ЧС$_3$	4,5 – 5,5	123	10,3	320	17,3	417	20,7
214 ЧС$_3$	3,5 – 4,5	104	10,6	269	17,2	369	17,7
181 ЧС$_4$	4,5 – 5,5	135	10,2	250	17,2	368	19,2
216 ЧС$_4$	3,5 – 4,5	123	10	224	18,3	349	19,7
Середнє	4,5 – 5,5	141	10,4	317	16,6	423	19,0
Середнє	3,5 – 4,5	126	10,8	277	16,7	375	18,9
НІР $_{05}$		14	1,2	13	1,4	15	1,2

Looking at the final result of the experiment (Table 3), we note higher productivity in samples sown by seed fraction of 4.5 – 5.5 mm. With all things being equal, a large seed of different forms of sugar beet (ЧС, O-type, F1) had a higher yield than a small fraction. This exceeding on average for three years amounted to 4.1 t/ha ranged within 2.5 – 5.0 t/ha was significant in comparable variants except hybrid yield in 2010.

Sugar content varied within the error of 0.5% with an average difference of 0.2% in the experiment for small fraction. Relative collecting of sugar per hectare was 0.7 t/ha higher by sowing seeds of a large fraction. Also collecting of sugar was higher when using the hybrid compared to other forms of sugar beet.

Productivity of sugar beet depending on the fraction of seeds, ,

Field number	Fraction, mm	Yield of root crops, t/ha			Sugar content	Collecting of sugar, t/ha
		2008	2009	2010		
201 F$_1$	4,5 – 5,5	57,3	54,2	47,8	18,8	10,0
202 F$_1$	3,5 – 4,5	54,6	51,6	45,5	18,6	9,4
203 ЧС$_1$	4,5 – 5,5	50,1	47,3	41,8	18,2	8,4
204 ЧС$_1$	3,5 – 4,5	45,3	42,7	37,7	18,6	7,8
206 ЧС$_2$	4,5 – 5,5	50,1	47,3	41,8	16,9	7,8
205 ЧС$_2$	3,5 – 4,5	44,7	42,2	37,3	17,2	7,1
208 От$_1$	4,5 – 5,5	50,3	47,5	41,9	19,6	9,1
207 От$_1$	3,5 – 4,5	45,1	42,6	37,6	19,6	8,2
210 От$_2$	4,5 – 5,5	50,5	47,7	42,1	18,6	8,7
209 От$_2$	3,5 – 4,5	46,1	43,6	38,4	19,1	8,2
215 ЧС$_3$	4,5 – 5,5	50,9	48,0	42,4	18,3	8,6

214 $ЧС_3$	3,5 – 4,5	46,1	43,6	38,4	18,4	7,9
181 $ЧС_4$	4,5 – 5,5	46,0	43,5	38,3	19,2	8,2
216 $ЧС_4$	3,5 – 4,5	42,6	40,2	35,1	19,7	7,8
Середнє	4,5 – 5,5	50,8	47,9	42,3	18,5	8,7
Середнє	3,5 – 4,5	46,4	43,8	38,6	18,7	8,0
$НІР_{05}$		2,8	2,9	3,2	0,6	

Conclusion. The experimental results show that the sowing of sugar beet by seeds of a large fraction (4.5 – 5.5 mm) provides better productivity. For typical soil and climatic conditions we can recommend sowing by seeds of a large fraction that at all levels of growth conditions will yield an increase within 2.3 - 5.4 t/ha of roots.

REFERENCES

1. Buzanov I.F. Morphological and biological features // Biology and selection of sugar beet. – Moscow: Kolos, – 1968. – P. 650 – 662.
2. Kolomiec O.K. Improvement of varieties and polyhybrids of single seed sugar beet in seed production process // Selection, agrotechnics and plant protection. – Kiev: VNIS – 1973. – P. 90 – 95.
3. Didik L.N. On the question of the study of seed germination of tetraploid, triploid and diploid forms of beet // Selection, agrotechnics and plant protection. – Kiev: VNIS, 1973. – P. 110 – 118.
4. Grytsyk M.S., Kyrychenko I.G., Vakulenko M.O. Reproductive properties of MS component // Sugar beets. – 2000 – № 5. – P. 20 – 21.
5. Balan V.M., Bevz V.V., Zagorodniy O.M. Fraction size and seed productivity of beet sugar // Sugar beets. – 1999. – № 5. – P. 8.
6. Osadchuk A.F. Dependence of yield and seed quality on timing and pollination multiplicity // Sugar beets. – 1999. – № 4. – P.16 – 17.
7. Balan V.M., Tarabrin O.E., Zagorodniy O.M., Bartoschuk I.I. Quality of seed grown by no planting method // Sugar beets. – 2000. – № 2. – P.16 – 17.
8. Korniichuk A.V. Formation of density of no planting seed plants // Sugar beets. – 2000. – № 6. – P. 6 – 7.
9. Yukhnovsky O.I. Impact on the quality of hybrid seeds of various growing conditions of crossbreeding components // Sugar beets. – 2000. – № 6. – P.6 – 7.

The productivity of sugar beets depending on seed fraction has been studied. It is proved, that plants grown from seed fraction of 5.5–4.5 mm have higher crop capacity than plants grown from seed fraction of 4.5–3.5 mm.

Key words: *productivity, seeds of sugar beets, seed fraction.*

Characteristic of sown properties of seeds of sugar beet for 2008–2010. Field number, fraction, mm, Germination, %, laboratory, field, weight of 100 seedlings, g, root borer lesions, %

The results of determination of the dynamics of growth of root crop weight and sugar content are summarized in Table. 2. Better plant growth trend persists for a large fraction of 4.5 - 5.5 mm. Plants of this fraction throughout the growing season better enlarged the mass of root crops, keeping the sugar content at the secondary level.

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Looking at the final result of the experiment (Table 3), we note higher productivity in samples sown by seed fraction of 4.5 – 5.5 mm. With all things being equal, a large seed of different forms of sugar beet (ЧС, O-type, F1) had a higher yield than a small fraction. This exceeding on average for three years amounted to 4.1 t/ha ranged within 2.5 – 5.0 t/ha was significant in comparable variants except hybrid yield in 2010.

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Productivity of sugar beet depending on the fraction of seeds, Yield of root crops, t/ha, Collecting of sugar, t/ha

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