Abstract. *Influence of different component seed treaters and their combination with AKM plant growth regulator on processes of seed germination, root and shoot growth was studied. It was determined, that seed treatment by treaters stimulates shoot growth during starting stages, while AKM usage stimulates shoot growth during all development stages. It should be noted, combination of AKM and studied seed treaters stimulates growth of primary roots except for mixes that have Lamardor.*

Key words*:* ***winter wheat, treatment products, plant growth regulator, seed, germination potential, similarity.***

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THE IMPACT OF CROP DENSITY AND SOWING TIME ON THE YIELD STRUCTURE OF GRAIN SORGHUM HYBRIDS

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Abstract. *Nowadays, Ukraine experiences a real sorghum boom since the extreme draught-resistance, high yielding capacity and stably increasing world demand for sorghum make this crop very perspective for domestic agrarians. Thus, special significance is ascribed to the research on developing basic techniques of growing grain sorghum in the southern region of Ukraine.*

The field research dealt with the following factors and their variants: the grain sorghum hybrids (Sontsedar, Praim, Burhho, Sprynt W, Dash-E and Tarhho), the sowing density and times.

The maximum grain productivity was achieved by the hybrid Dash-E under the early sowing time and the crop stand density of 180 thousand pieces per hectare – 6,69 t/ha, and the hybrid Sontsedar under the density of 140 thousand pieces per hectare – 6,54 t/ha. The leader under the late sowing time was the hybrid Dash-E with the yield of 3,96 t/ha under the crop stand density of 180 and 220 thousand pieces per hectare. Other hybrids had considerably lower yields.

The prospects of sorghum crops will look good and they will be economically profitable in Ukraine, if the cultivation of these crops is supported with scientific advances – technologies and new highly productive varieties and hybrids. Nowadays, the cultivation of grain sorghum has great potential and requires a thorough study.

Key words: grain sorghum, hybrids, sowing density, yielding capacity, sowing time.

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Problem statement. Rigorous climatic conditions in the main grain-growing regions make agricultural producers pay attention to nontraditional crops, which are capable of producing yields and generating profit even in a dry season [1].

Nowadays, Ukraine experiences a real sorghum boom since the extreme draught-resistance, high yielding capacity and stably increasing world demand for sorghum make this crop very perspective for domestic agrarians. Grain sorghum is a perfect alternative for barley, corn, sunflower under conditions of the arid climate in the South and East of Ukraine and is capable of maintaining stable high yields [2]. Thus, special significance is ascribed to the research on developing basic techniques of growing grain sorghum in the southern region of Ukraine.

State of the problem under investigation. Biological features of growth and development of grain sorghum have been studied by a number of domestic and foreign scientists [7–10]. Tillering is an important stage of grain sorghum development. At this stage the shoots emerge, and reproductive structures of the panicle form [3]. The optimal sowing time of grain sorghum corresponds to the date when the soil is warmed to 12–16C ^{o} at the seed depth [5, 6].

But the problem of improving technologies of growing new varieties and hybrids of grain sorghum, including different crop stand of the plant at different sowing times, has not been studied thoroughly.

Tasks and methodology of the research: to increase grain sorghum productivity under non-irrigated conditions of the South of Ukraine by optimizing the nutrition area of the plants under different sowing times and to identify grain sorghum hybrids, which are well adapted to the conditions of the region.

While studying this problem we set the following tasks: to analyze the peculiarities of growth and development processes of sorghum hybrids under the influence of different crop stand density and different sowing times under conditions of the South of Ukraine; to study the impact of different crop stand density on biometrical indices of sorghum hybrids according to the stages of growth and development; to characterize water consumption of sorghum hybrids depending on the crop stand density and weather conditions during the crop growing season at different sowing times; to define the impact of the crop stand density on the grain yields of sorghum hybrids with different sowing times.

The research was conducted in 2013–2015 on the experimental fields of SHEI “Kherson State Agricultural University”, located in Korabelny district of Kherson region on the Black Sea lowland of the Steppe zone of Ukraine. The characteristic feature of dark chestnut soils is a clear differentiation of the profile according to the eluvial and illivial type, that is related to salinity of these soils. The general power of the humus profile of these soils is low – 25–30 cm. Humus content in the arable layer is medium – 2,2–2,9%.

Three-factor research was carried out with the method of randomized split plots. The experiment was repeated four times. The area under grain was 86,0 m^2, the registered area was 50,0 m^2 [4].

The field research dealt with the following factors and their variants: the grain sorghum hybrids (Sontsedar, Praim, Burhho, Sprynt W, Dash-E and Tarhho), the sowing density and times (the early one – the first decade of May, the late one – the third decade of May).

Results of the research. The main criterion of assessment of the cultivation technology is the level of the crop yield, which most thoroughly determines the impact of the factors under investigation (Table 1).

1. The yield of the grain sorghum hybrids depending on the factors under investigation, t/ha (average for 2013–2015)

№	Hybrid	The crop stand density, thousand pieces per hectare			
		100	140	180	220
The early sowing time (the 1st decade of May)					
1	Praim (standard)	3,20	4,54	4,62	3,83
2	Sontsedar	5,64	6,54	4,88	4,79
3	Burhho	4,38	5,50	5,00	4,29
4	Sprynt W	2,96	2,93	3,16	3,49
5	Dash-E	4,55	6,23	6,69	5,26
6	Tarhho	3,83	4,98	5,60	4,58
The late sowing time (the 3rd decade of May)					
1	Praim (standard)	1,75	2,43	1,70	1,60
2	Sontsedar	2,67	2,18	2,29	2,05
3	Burhho	1,93	2,39	1,94	2,28
4	Sprynt W	1,43	1,39	1,25	1,45
5	Dash-E	3,29	3,52	3,96	3,96
6	Tarhho	2,59	2,61	3,20	2,64

The least essential difference – LED_{05} for the years of the research for the interaction of the factors ABC was 0,13 – 0,50 t/ha.

The highest average yield for the years of the research (2013–2015), was achieved by the hybrid Dash-E under the early sowing time and the crop stand density of 180 thousand pieces per hectare – 6,69 t/ha, and the hybrid Sontsedar under the density of 140 thousand pieces per hectare – 6,54 t/ha. The hybrid Burhho had the maximum productivity – 5,5 t/ha under the density of 140 thousand pieces per hectare, and the hybrid Tarhho – 5,6 t/ha under the crop density of 180 thousand pieces per hectare. Thickening the crops to the density of 220 thousand pieces per hectare caused decreased productivity of most hybrids.

The leader under the late sowing time was the hybrid Dash-E with the yield of 3,96 t/h, under the crop stand density of 180 and 220 thousand pieces per hectare. Other hybrids had considerably lower yields.

An important indicator of grain quality is the weight of 1000 grains (Table 2).

The highest weight of 1000 grains was in the hybrid Sontsedar under the early sowing time, it was 22,4 g under the crop density of 100 thousand pieces per hectare, and 20,1 g under 140 thousand pieces per hectare.

Under the late sowing time the maximum index was in the hybrids Dash-E and Burhho, it reached the level of 19,5 g.

2. The impact of the factors under investigation on the weight of 1000 grains of the grain sorghum hybrids (average for 2013–2015)

№	Hybrid	The crop density, thousand pieces per hectare			
		100	140	180	220
The weight of 1000 grains (the early sowing time), g.					
1	Praim(standard)	16,1	16,1	16,0	15,3
2	Sontsedar	22,4	20,1	18,2	17,0
3	Burhho	18,8	18,5	17,9	16,5
4	Sprynt W	17,1	17,1	17,0	16,3
5	Dash-E	19,8	18,0	17,9	17,8
6	Tarhho	19,6	18,1	17,6	16,2
The weight of 1000 grains (the late sowing time), g.					
1	Praim(standard)	17,1	16,3	16,4	16,5
2	Sontsedar	17,5	17,5	17,5	17,4
3	Burhho	19,6	18,8	16,2	15,6
4	Sprynt W	15,7	15,6	14,9	14,7
5	Dash-E	19,5	18,8	18,2	17,2
6	Tarhho	18,3	16,8	16,7	15,8

The data illustrating the indices of the grain weight from one panicle for the years of the research are given in Table 3.

The grain weight from one panicle was the highest in the hybrid Sontsedar under the early sowing time – 56 g under the crop density of 100 thousand pieces per hectare, with the increase of the crop density this index had a tendency to decrease in all the hybrids under investigation. Under the late sowing time the highest grain, weight from one panicle was in the hybrid Dash-E, it was 39,6 g under the crop density of 180 thousand pieces per hectare.

3. The impact of the factors under investigation on the grain weight from one panicle of the grain sorghum hybrids (average for 2013–2015)

№	Hybrid	The crop density, thousand pieces per hectare							
		100	±	140	±	180	±	220	±
Under the early sowing time (the 1st decade of May), g									
1	Praim(standard)	32	-	32	-	26	-	17	-
2	Sontsedar	56	+6,3	47	+4,0	27	+2,2	22	+1,7
3	Burhho	44	+2,7	41	+2,4	26	+1,9	19	+1,2
4	Sprynt W	30	+1,0	21	+1,0	18	+1,0	16	+1,0
5	Dash-E	45	+3,7	42	+1,9	41	+1,9	23	+2,5
6	Tarhho	38	+3,5	36	+2,0	31	+1,6	20	+0,9
Under the late sowing time (the 3rd decade of May), g									
1	Praim(standard)	18	-	24	-	17	-	16	-
2	Sontsedar	27	+0,4	22	+1,2	23	+1,1	21	+0,9
3	Burhho	19	+2,5	24	+2,5	19	-0,2	23	-0,9
4	Sprynt W	14	-1,4	14	-0,7	13	-1,5	15	-1,8
5	Dash-E	33	+2,4	35	+2,5	40	+1,8	40	+0,7
6	Tarhho	26	+1,2	26	+1,5	32	+0,3	26	-0,7

An important index determining the productivity of sorghum crops is their inflorescence length – their panicle length (Table 4).

4. The impact of the factors under investigation on the panicle length of the grain sorghum hybrids (average for 2013–2015)

№	Hybrid	The crop density, thousand pieces per hectare			
		100	140	180	220
Under the early sowing time, cm.					
1	Praim(standard)	23	23	20	17
2	Sontsedar	27	24	22	24
3	Burhho	25	24	21	19
4	Sprynt W	24	24	24	21
5	Dash-E	24	24	23	19
6	Tarhho	22	20	20	17
Under the late sowing time, cm.					
1	Praim(standard)	21	19	20	12
2	Sontsedar	22	23	20	18
3	Burhho	19	19	16	15
4	Sprynt W	22	21	18	18
5	Dash-E	19	19	16	18
6	Tarhho	19	19	18	15

As for the length of the aggregate inflorescence “panicle”, characteristic of grain sorghum, it was the longest in the hybrid Sontsedar under the first sowing time and the crop stand density of 100 thousand pieces per hectare, it was 27 cm, ant it reached 23 cm under the second sowing time and the crop stand density of 140 thousand pieces per hectare. The panicle length of all the grain sorghum hybrids decreased with the increase of the crop density.

Conclusions.

1. The maximum grain productivity under the early sowing time was achieved by the hybrids Dash-E, under the crop density of 180 thousand pieces per hectare – 6,69 t/ha and Sontsedar under the crop density of 140 thousand pieces per hectare – 6,54 t/ha.

2. The leader under the late sowing time was the hybrid Dash-E with the yield of 3,96 t/ha, under the crop stand density of 180 and 220 thousand pieces per hectare. Other hybrids had considerably lower yields.

3. The highest weight of 1000 grains was in the hybrid Sontsedar under the sowing density of 100 thousand pieces per hectare – 22,4 g under the early sowing time.

4. The length of the grain sorghum panicle had a tendency to decrease with the increase of the crop density.

Prospects of further research. The prospects of sorghum crops will look good and they will be economically profitable in Ukraine, if the cultivation of these crops is supported with scientific advances – technologies and new highly productive varieties and hybrids. Unfortunately, little attention is paid to the research on developing modern cultivation technologies, and new scientific

techniques are slowly implemented. Nowadays, the cultivation of grain sorghum has great potential and requires a thorough study.

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ВПЛИВ ГУСТОТИ ПОСІВІВ ТА СТРОКІВ СІВБИ НА СТРУКТУРУ ВРОЖАЮ ГІБРИДІВ СОРГО ЗЕРНОВОГО

М. О. Бойко

Анотація. *У статті висвітлено основні аспекти технології вирощування сорго зернового. Виявлено, що збільшення продуктивності сорго зернового можливе шляхом оптимізації площі живлення рослин за різних строків сівби та посіву гібридів, найбільш адаптованих для умов регіону.*

Ключові слова: сорго зернове, гібриди, густота посіву, врожайність, строки сівби.

ВЛИЯНИЕ ГУСТОТЫ ПОСЕВА И СРОКОВ СЕВА НА СТРУКТУРУ УРОЖАЯ ГИБРИДОВ СОРГО ЗЕРНОВОГО

Н. А. Бойко

Аннотация. *В статье отражены основные аспекты технологии выращивания сорго зернового. Выявлено, что увеличение производительности сорго зернового возможно путем оптимизации площади питания растений, при разных сроках сева и посева гибридов, наиболее адаптированных для условий региона.*

Ключевые слова: сорго зерновое, гибриды, густота посева, урожайность, сроки посева.