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# TO THE QUESTION OF THE TECHNIQUE OF BREEDING SWEET SORGHUM FOR PRODUCING OF LIQUID BIOFUELS IN COMBINED SEEDS WITH OTHER CULTURES

*The results of research on developing methods of breeding sugar sorghum as bioenergy crop by compatible sowing with seed plants of sugar beet are given.*
***Keywords:*** *sugar sorghums, seed plants of sugar beet, combined seeds*

**Introduction.** Today, an ever-growing shortage of oil products, their high cost and deterioration of ecological factors of the environment that negatively affect the organisms or its separate functions, lead to the search of alternative environmentally friendly power sources. In this regard use of the energy accumulated by plants as a result of their photosynthetic activity is actual. The most widespread in the world are corn, sugar beet, sugar sorghum and others.

In Ukraine, one of the alternative sources for production of biofuel can be sugar sorghum, which is now cultivated in pure, mixed and compacted crops, which includes pure or combined sawing with other crops (corn, soybeans ) sowing in early May with a width of 70 cm between rows and the seeding norm is 8-10 kg/ha [2]. However economically disadvantageously to cultivate sugar sorghum as energy crop in pure crops which vegetable mass is processed instead of using fodder purposes. As were shown by previous studies, this problem is best solved by combined spring sowing of two crops: sugar sorghum + uterine beet. Due to the exception of expenses on soil preparation, sawing and other agrotechnical measures for combined sowing, costs are reduced for 25-30% for cultivation of 1 t of production of cultures compared with conventional pure sowing [3, 6].

The aim is to establish the regularity of the process of formation of the elements of sugar sorghum productivity by combined sawing with other crops and improve the technology of their cultivation.

**Materials and research technique**. Researches were conducted on the Soviet breeding station of the Crimea (2010-2013), the Ivanovo RBS (2010-2013). Thereto was carried out combined sawing of sugar sorghum Sylosne and sugar beet hybrid Ukrainsky MS 70, the breeds Medovy and Ivanivsko-Veselopodilsky MS 84. Research was conducted according to standard methodical recommendations [2] and "State quality crop test-breeding methodology" [5].

The statistical analysis of results of researches was carried out by the variation, dispersive and correlative methods with use of the computer Statistica program - 6 [1].

**Results of research.** On the basis of the conducted researches was worked out and proved a method of cultivation of sugar sorghum with other crops by the following technology elements:

**1. Combined culture**

1.1. One of the main conditions of growing technology of sugar sorghum by combined sawing is the choice of other cultures according to this soil and climatic zone.

1.2. The researches conducted in the southern regions of Ukraine in different years (The Autonomous Republic of Crimea, the Kherson region, the Kirovograd region) show that in this region cultivation of sugar sorghum in combined sowings with sugar, red and fodder uterine beet is quite possible.

**2. Seeding technology**

2.1. Combined crops of sugar sorghum and beet on seeds place in the same field, suitable for pure sowing. To prevent the spread of diseases and pests do not sow them after sugar, fodder beet and their seed plants.

2.2. Soil conditioning has to provide alignment of its surface and receiving friable small shallow nubble of soil (soil particles less than 10 mm about 90%; 10-25 mm - 7%, and 25-30 mm

only 3%). It is carried out by the Aggregate АРВ-8,1-0,2)", by the rearer УСМК-5,4Б, shovel cultivator ВНІЦ РС .

2.3. Under-sowing is carried out by beet and vegetable seeders (in seed capacities fill up beet seeds, in fertilizer - seeds of cover plant).

2.4. Terms of combined sowing establish according to recommendations about cultivation of sugar sorghum for this zone (April, May).

2.5. Recommended norms of seeding of sugar sorghum is 10-12 kg/hectare, beet of 25-30 pieces/m, or 12-15 kg/hectare and 12-15 pieces/m.

3**. Care of crops**

3.1. After crops it is obligatory rolling crops by star-wheeled roller .It allows to increase field germination by 15-20% and to receive uniform sprouts.

3.2. In the phase of 4-5 leaves of sorghum was carried out harrowing crops across rows with loading no more than 0,6 kg on harrow tooth, unit speed - 4,5 km/hour.

**4. Cropping combined cultures**

4.1. Harvesting sugar sorghum for biofuel production was carried out in the phase dairy - wax ripeness by direct combining on a high cut.

4.2. Combined culture - beet on the seed purposes by indirect way of cultivation leave in the field for rewintering, by direct way collect in the first - the second decades of October and store in temporary or stationary storages.

**5. Accounting and monitoring**

5.1. Distribution of seeds of combined cultures on depth and their field viability.

5.2. Phenological observations of the phases of growth and development.

5.3. Density of standing of plants of sugar sorghum and uniformity of distribution in the row: in the period of full sprouts and before harvesting.

5.4. Dynamics of accumulation of green and dry material on the main phases of growth and development by the method of sampling from 10 plants and their weighting. Dry matter content - by drying the plant samples in an oven at t -105 $^0$C to constant weight.

5.5. Accounting weeds: in the period of full sprouts, before harvesting by the method of imposing of the frame of 0,25 m along the row in field plots in two repetitions.

5.6. Accounting pests and diseases in the period of full sprouts and before harvesting - respectively on 1 sq.m on a diagonal of each plot and 25 plants located near each plot on a 5- point scale: 0 - plants aren't damaged, 1 - 25% of plants are damaged, 2 - 25-50%, 3 - 50-75%, 4 - more than 75% of plants are damaged.

5.7. Structure of the sorghum crop: plant height, diameter of stem, leaf surface area , mass of plants , the content in the green mass of panicle before harvesting.

5.8. Accounting crop - by method of beveling and weighting of green mass of each plot.

5.9. Dry matter content in the green mass, total sugar and reducing substances calculated according to data of laboratory analyses.

5.10. Exit of bioethanol, firm biofuel and energy from it - a settlement method.

**Conclusions**. Application of technique of cultivation of sugar sorghum as biopower culture in compatible crops with uterine beet - the perspective direction in production of biofuel. It will provide full use of arable area, increase of productivity and economic efficiency of technology of compatible crops.

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***Анотація***

***Сторожик Л.І.***

***До питання методики вирощування сорго цукрового для виробництва рідкого біопалива в сумісних посівах з іншими культурами***

*Наведені результати досліджень з розробки методики вирощування сорго цукрового як біоенергетичної культури за сумісної сівби з насінниками цукрових буряків.*

***Ключові слова:*** *сорго цукрове, насінники цукрових буряків, сумісні посіви*

***Аннотация***

***Сторожик Л.И.***

***К вопросу методики выращивания сорго сахарного для производства жидкого биотоплива в совместных посевах с другими культурами***

*Приведены результаты исследований по разработке методики выращивания сорго сахарного как биоэнергетической культуры в совместных посевах с семенниками сахарной свеклы.*

***Ключевые слова:*** *сорго сахарное, семенники сахарной свеклы, совместные посевы*