RESEARCHERS ON THE BEHAVIOR OF SUGAR BEET HYBRIDS IN THE PEDOCLIMATIC CONDITIONS OF THE CENTRAL PLATEAU OF MOLDOVA

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Abstract

The main purpose of the research was to test the productive and qualitative potential of 36 sugar beet hybrids from four international suppliers. The research was carried out in 2021, in two farms with high-performance plant cultivation technologies: Agricola 96 from Tiganasi, Iasi county (irrigated regime) and Agri Farm Ltd. from Balanesti, Neamt county (non-irrigated regime). The maximum biological sugar production in the irrigated system was 11.15 to/ha (hybrid Fiammeta), and in the non-irrigated system 12.20 to/ha hybrid Borjana). Knowing the productive and qualitative potential of sugar beet hybrids depending on the local pedoclimatic conditions, is a basic requirement in choosing the palette of hybrids that will be cultivated in the following years.

Key words: sugar, yield, irrigated beet, technology

Sugar beet (*Beta vulgaris var. saccharifera* L.) is an important industrial crop and, along with sugar cane, it is one of the two plant sources from which sucrose (i.e. sugar) is extracted. In 2017, sugarcane and sugar beet contributed to total world sugar production with 75% sugarcane and 25% sugar beet (Stanescu Z. *et al* 2003).

However, this proportion has shifted significantly in favor of sugarcane in recent decades – from 63% to 37% in 1982. But sugar beet is now becoming an important biofuel alternative to fossil fuel energy (Pascu A. *et al* 1996).

Although sugar beet is a relatively new crop compared to other widely cultivated crops, it has undergone significant improvements, considering that it only began to be cultivated about 200 years ago. The sucrose content of wild beet is 4 to 6%, but the sugar beet was selected from fodder beet, which has a sucrose content of 12%. This level has increased to about 20% in recently developed commercial crops (Micluță V. *et al*, 1982).

Conventional breeding methods played a major role in these improvements. However, in the last two decades, advanced biotechnological methods have been combined with classical breeding approaches, with the main aim being the production of herbicide-tolerant and disease- and pest-resistant varieties. To meet all the prerequisites of sustainability, agriculture must find the right trade-offs between current and future production levels, so as not to jeopardize long-term potentials (Popescu V. *et al*, 1988).

To this end, fertilizers must be used more efficiently to avoid releases to groundwater and the atmosphere. It will also be necessary to search for effective and environmentally friendly pesticides and herbicides (Bârsan Simona-Clara *et. al*., 2012).

Exploitation of available and novel genetic sources for usable variation controlling resistance and/or tolerance to biotic and abiotic stress certainly needs to be improved. Advances in molecular genetics and biotechnology are expected to contribute significantly to this goal (Mogârzan A. *et al*, 2004).

The sustainability of modern sugar beet cultivation has been shown to be considerably high. Its improvement was gradual, rationalized with relevant advances in crop growth and breeding. However, there are still opportunities for much needed sustainable intensification of sugar beet production (Pușcaș A.M. *et al*, 2008).

In order to reduce entry practices it is expected that by using powerful new molecular techniques, new sugar beet varieties will be

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developed that would potentially improve beet sugar production (Roman G.V. *et al*, 2012).

MATERIAL AND METHOD

The purpose of the research is to determine the productive and qualitative potential of sugar beet hybrids that will be used in the future in commercial farms in the Moldova area.

The testing of beet hybrids was carried out in two farms: SC Agricola 96 SA from Tigănaşi, Iaşi county (irrigated regime) and SC Agri Farm SRL from Bălăneşti, Neamţ county (non-irrigated regime).

Brief description of farms: AGRICOLA 96 SA Tiganasi specializes in:

- the sale of pesticides: Bayer, Basf, Syngenta, Adama, FMC, Arysta, Summit Agro, DuPont;
- commercialization of chemical fertilizers: Azomureş, Timac Agro Romania;
- the sale of seeds of our own production: Fundulea 376, Olt, Performer and from other companies: Pioneer, Syngenta, RAGT, KWS, Monsanto, Euralis, Caussade;
- cultivation and marketing of cereals, plants producing oleaginous seeds;
- – provision of services in agriculture;
- – sale of Claas, Lemken, Amazone spare parts;
- – agricultural consultancy;
- raising milk and meat cows.

SC Agri Farm SRL carries out activities consisting of "Growing cereals, leguminous plants and oil seeds plants" by exploiting legally owned agricultural land and its cultivation with cereals and technical and energy plants.

Activity is directed towards the production and selling of agricultural products obtained on the farm. These are sold on the internal market, through firm contracts signed with businesses in the field.

Currently SC Agri Farm SRL operates as a medium-sized farm, its efficiency increasing as the crops yield increase, as the tools and equipments serving the farm increase in productivity, and as the costs for transport, storage, preservation and packaging of agricultural products obtained from our lands decrease, and as revenue is generated by providing services to third parties.

Experimental protocol: experiment was monofactorial with 36 sugar beet hybrids, in three repetitions. Production indicators: the amount of roots (to/ha) and the sugar content of the roots (% sugar). Production indicators: the amount of roots (to/ha) and the sugar content of the roots (% sugar).

At the SC Agricola 96 SA farm, the cultivation technology was a conventional one, from which we point out the following elements:

Predecessor plant: wheat;

Tillage: Horsch cultivator at 30 cm;

Preparation of the germinal bed: combinator at 5 cm depth;

Pre-emergence herbicide (fenmedipham, etofumesate, metamitron) and post-emergence (clopyralid, triflusulfuron-methyl);

Basic fertilization:

- 500 kg of complex fertilizer NPK 14/14/14 scarified;
- 150 kg of nitrolimestone, applied on May 5 (p.p.g.);
- 100 kg of UAN liquid fertilizer (32% nitrogen), applied on June 3.

Pest control (cypermethrin) and pathogens (difenoconazole, flutriafol).

At the farm SC Agri Farm SRL, the following technology elements were monitored:

Sowing date: April 7;

Seed rate: 1.1 UG/ha;

Distance between rows: 45 cm

Sowing depth 3-4 cm;

Crop thickness at sunrise: 10 plants/m^2

RESULTS AND DISCUSSIONS

In order to have an overview of sugar beet production and how the hybrids behave under the selected conditions, most of the hybrids on the market from the main companies that produce and distribute the seed were studied.

Thus, the hybrids under study belong to the following companies: SES VANDERHAVE (Terra, Ondava, Trivor, Wojownick, Bakony, Bukovina, Herend, Darvas, Deseda, Kipunji Smart, Hopper Smart), STRUBE (Tesla, Livius, Zeppelin, Justus, Steve, Noel, Pintea, Benon, Tyson, Fischer, Damian, Vangelis), firm MARIBO (Vanilla, Mh 2043, Armesa, Music, Sixtus, Heston, Kristof) and KWS (Vandana, Melindia, Gilberta, Grandiosa, Borjana, Fiammeta)

In the irrigated regime, 7 hybrids exceeded the production of 75 t/ha of roots.

In non-irrigated only 9 hybrids had a production higher than 55 t/ha of roots.

Regarding the sugar content of the roots:

- in the irrigated regime only 2 hybrids had more than 13.5% sugar;
- in the non-irrigated regime, 5 hybrids had a polarization greater than 15.5%.

Regarding sugar production/ha, 9 hybrids achieved over 9 t/ha of biological sugar, and in non-irrigated regime only 3 hybrids exceeded the threshold of 9.

The results show that the highest production per hectare, irrigated, within the SC Agricola 96 SA farm was obtained with the Fiammeta hybrid, this being 93.89 t. In most of the hybrids studied from this farm, the differences in production are very small, these being stable. One of the factors

leading to stability is the water factor administered in optimal phenophases.

The lowest production in the irrigated crop was obtained in the Desseda hybrid, which was 62.95 kg/ha.

Analyzing *figure 1* and comparing the production results between the irrigated and non-irrigated conditions, we can see that the differences are approximately 25-30% in all the hybrids studied.

Sugar, or sucrose as the main products obtained from this industry, varied as a percentage of participation in production (figures 2). As with the amount of rhizocarps, the highest sugar production was also obtained in the hybrid Borjana and is 12.20% in case of non-irrigated, and the highest production in non-irrigated was obtained in the hybrid Fiameta, which is 11.15%.

In the case of sugar concentration, it can be seen that it is influenced by the amount of water available during the vegetation period.

Only one hybrid is an exception, namely Borjana whose production was 12.20%. Unlike the production of rhizocarps where the values are approximately constant, for sugar they are highly variable.

From the graph (*figure 2*) it can also be seen that irrigation offers an approximately constant production of sugar. In irrigated conditions, the lowest production was obtained in the Kristofor variant and was 7.50% in irrigated and 4.84% in the Justul hybrid in non-irrigated. As with rhizocarp production, there is a mean difference between non-irrigated and irrigated varieties in sugar production.

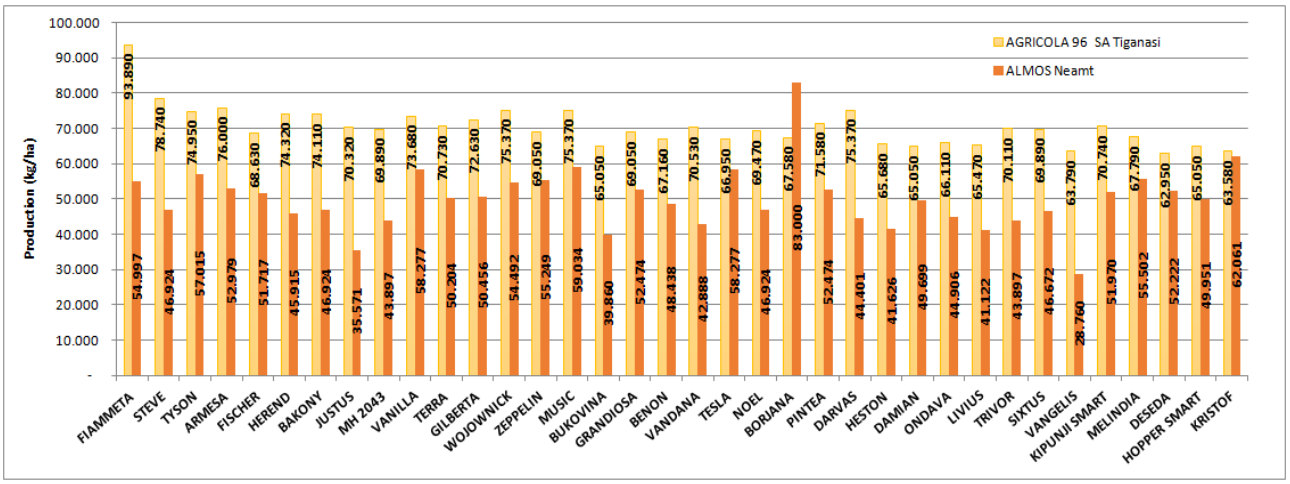

Figure 1 **Rhizocarp production in the two study conditions (irrigated/non-irrigated)**

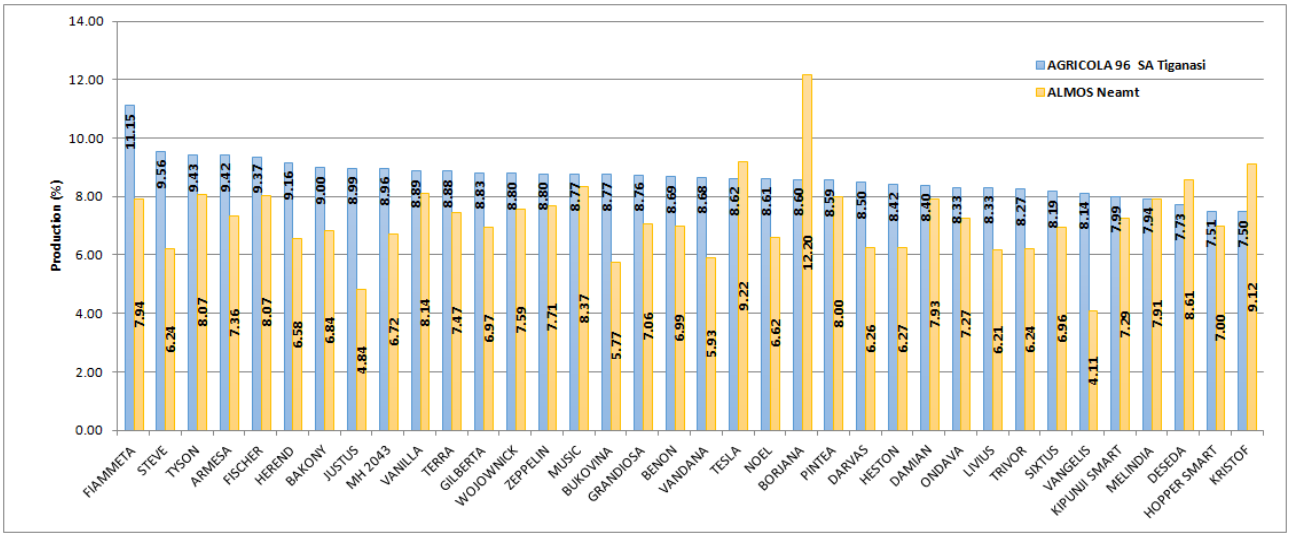

Figure 2 **Sugar production (%) in the two study conditions (irrigated/non-irrigated)**

CONCLUSIONS

The production of roots per hectare in the irrigated regime is 36% higher than the non-irrigated culture;

The production of biological sugar per hectare is superior in the irrigated regime, even if the polarization is lower than in the non-irrigated regime;

In the irrigated regime, the first 10 hybrids achieve an average production of 9.41 t/ha of biological sugar (Fiammeta record - 11.2 t/ha);

In non-irrigated, the first 10 hybrids achieve an average production of 8.77 t/ha of biological sugar (Borjana record - 12.2 t/ha);

ACKNOWLEGMENTS

Influence of the biofertilizer product Ecofertil P on agricultural production', 20045 of 15/11/2022

REFERENCES

Bârsan SC, Luca E, 2012 - *Research Concerning the Economic Efficiency of Irrigation for the Sugar Beet Cultivated in the Transylvanian Plain*. Revista Agricultura-Revista de ştiinţă şi practică agricolă, 21(1-2).

Manea G, 2003 - *Elemente pentru o politică naţională de promovare a biocombustibililor, Promovarea în România a surselor regenerabile de energie*, Editura CHIMINFORM DATA, Bucureşti;

Mogârzan A, Morar G, Ştefan M, 2004 – *Fitotehnie*. Editura „Ion Ionescu de la Brad", Iaşi;

Micluță V, 1982 – *Perspective ale intensifizării în producția și industrializarea sfeclei de zahăr.* Editura Ceres, București.

Stanescu Z, Doncila A, Tanase V, 2003 - *Cultura sfeclei de zahăr*. Editura GEEA, Bucuresti.

Pascu A, Badiu A, 1996 – *Dicționar al culturii sfeclei de zahăr*. Editura Cartea Specialistului;

Popescu V, Stroia A, 1988 – *Tehnologii moderne pentru creșterea producției și a valorii de industrializare a sfeclei de zahar*. Editura Ceres, București.

Pușcaș AM, Luca E, Bârsan SC, Ceucă V, Simu A, 2008 - *Experimental results obtained in sugar beet crop technology and water consumption specific to Transylvania's field conditions*. Buletin USAMV, Horticultura 65(2):528-532.

Roman GV et al, 2012 - *Fitotehnie. Plante tehnice, medicinale si aromatice - Volumul II*. Editura Ceres.