

Productivity and Resistance of Parental Forms and Hybrid of Sugar Beet Which are Tolerant to Rhizomania Disease

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Abstract: *The selected varieties and hybrids of sugar beet tolerant to the viral Rhizomania disease / Beet necrotic yellow virus / is one of the innovative fields in the selection of sugar beet. The aim of the present research is to track the economic properties of the new sugar beet hybrids tested under conditions of absence of the viral disease. It is found that among the tests new hybrids outweigh the group standard by 6.7% in yield of white sugar. Hybrids tolerant to the disease have a higher resistance to fungal diseases cercospora / Cercospora beticola /and mildew /Erysiphe communis. It has been found that the decay of roots in the tolerant to Rhizomania hybrids had proved to be lower (52%) than that of the standard.*

Keywords: *sugar beet, selection, resistance, tolerance, Rhizomania, fungal diseases.*

1. INTRODUCTION

Nowadays about 90 million ha of sugar beet are grown. Currently in the world are over 90 million acres of sugar beets. The major producers are Ukraine, France and the United States who annually grow 5-8 million ha.

The highest consumption of sugar in the world is in Austria, Great Britain, Ireland, Russia, Canada and others. This is about 40 kg per capita. With the least consumption are Japan, Turkey, Denmark (about 23-24 kg). Bulgaria occupies a prestigious place in the top ten worldwide with 35 kg of sugar consumed per capita.

The role of crop variety is very precise and explicitly formulated. This is a means of production which, under certain soil and climatic conditions and suitable technology ensures particular yields. Sugar beet is relatively flexible crop, but despite it in the southern latitudes of the temperate zone it is often attacked by fungal diseases and conditions in the northern regions favor the boltind. These features, as well as the specific soil and climatic conditions almost every country that cultivates sugar beet has organized its own breeding and seed production of highly productive varieties and technology for their cultivation.

The selected varieties and hybrids of sugar beet tolerant to the viral Rhizomania disease / Beet necrotic yellow virus / is one of the innovative aspects in the selection of sugar beet.

1.1. Literature Review

At the current stage of beet growing the most serious damage is caused by viral viral Rhizomania disease.(Uchkounov and Uchkounova, 2003) Our observations show that the yield of root crops declines considerably. The technological qualities of the raw material are deteriorated sharply. It is not a rare case when the whole harvest is compromised. The main characteristic of Rhizomania lies in the proliferation of roots. In 1995 there have been infected more than 400 thousand ha with the virus of Rhizomania in Europe (Knappe 1997). In Bulgaria the infected with the virus of Rhizomania areas are about 15 thousand ha and they are mainly in the areas of sugar factories Gorna Oryahovitsa, Russe and Kameno - Burgas.

During the vegetation in the main root of the beet a number of alterations are observed. In general they can testify about the presence of the virus. In cross-section transverse necrotic circles are easily noticed. When the disease appears later the root crop is usually well-developed and secondary roots are observed only in the top part or in separate branches of the main root.

Tanova (2003) proves that the fungus *Polymyxa betae* carries the virus BNYVV, causing disease of Rhizomania in sugar beet (Harveson and Rush 1994). This fungus is described by Keskin. In our country the disease was discovered in the region in 1983 in Radnevo, Haskovo, initially symptomatically and subsequently the disease was diagnosed in France by the method of ELISA (Uchkunov, 2008)

Fighting viral disease of Rhizomania is very difficult because once entering the soil it is practically almost impossible for it to be cleansed. Direct anti-virus control is impossible, and the fight against vector of *Polymyxa beate* does not give satisfactory results.

For now, the most reliable way to overcome the negative effects of the disease is the development of varieties of tolerant sugar beet which in infected rhizomes with Rhizomania soils guarantee a normal yield with relatively good technological qualities of the raw material. (Zelyazkov and Uchkunov,2005)

Currently the created genetical-selective material as well as the skills of virologists and breeders give confidence that overcoming the phenomenon of Rhizomania is possible (Desprez and Desprez, 1998 Kikindonov et al.,2010). The first Bulgarian variety called Radnevo tolerant to Rhizomania was recognized in 1990 and it was introduced into cultivation in 1991 -1992 (Uchkunov, 2008).

Purpose of the research

The aim of this study is to track the agricultural features and resistance to fungal diseases of the newly created hybrids of sugar beet tolerant to the viral disease of Rhizomania.

2. MATERIAL AND METHODS

Studies were conducted in the Agricultural Institute of Shumen – scientific research field of "Crop" and *Konstantin Preslavsky* University of Shumen during the period between 2012-2013.

In topic developing the topic the following selection materials from these breeding gene pool of Agricultural Institute, which is included in the group for the conservation of genetic resources in the EU (Uchkunov et al., 2015)

- Standard varieties for Bulgaria - Peshtera and Dieks and diploids and single-fruit male sterile lines № № 6634, 201, 222, 5524, 5332 and 5140 as well as and their single-fruit triploid monogerm hybrids.
- Tetraploid multiple pollinators - 5319R, 4499R and 5314R viral disease of Rhizomania.

In tracking the productive and economic qualities of selection materials is based on field experience.

The experience is set according to two-place-grid method – with 36 variants in four repetitions and size of the test lot 10.8 m².

3. RESULTS AND DISCUSSION

The results received from the research on the productivity of the newly created hybrids and parent varieties tolerant to the viral disease of Rhizomania are presented in Table 1.

It has been found that according to the yield of root crops per ha, the highest yield had been observed in hybrids with the participation of the multiple pollinator, tolerant to Rhizomania, 4499, where the yield reaches 3985kg / da. It has been proved to have higher yield in three hybrids.

In terms of sugar content in root crops the average for all hybrids reaches 15.62%. The overall highest sugar content is found in hybrids featuring genotype of 4499 as a father component (15.95%). It is noteworthy to mention that there is a high percentage of sugar content of multiple pollinators as highest is that of 5319-16.84%.

Essential in the production of sugar molasses are the forming factors. From the study it is apparent that both the standard and the resulting hybrids average content of soluble ash is below 0.400%, which in practice is considered that the raw material is of good quality. The data shows that 73% of the hybrids exhibit relatively low soluble ash compared with the standard.

The yield of white sugar is the most important technological indicator. The average for the standard yield of white sugar reaches 13.02%. The highest yield is observed with the hybrid combination MS201x5314 where excess over the standard is 112%, the difference is very well supplied.

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The yield of white sugar per ha, as resultant value indicates that newly created hybrids generally excel the group standard. As promising for selection are the hybrids MS222h5319 and MS201h4499 where the excess is with 17.6% and the difference is demonstrated for GD 0.1%. The results show that on average the new test hybrids tolerant to the viral disease of Rhizomania are superior the group standard with 6.75%.

Table1. Productivity of hybrids and parental components of sugar beet tolerant to the

Origin	Root yield kg/da	Sugar content %	Soluble ashes %	Output %	Whitesugar yield kg/da
Standart	3850	15,16	325	13,02	502
MC5140X5319	99,8	106,5	89,9	106,7	106,5
MC5332X5319	103,7	98,0	103,0	99,1	102,8
MC5524X5319	99,3	96,3	101,9	95,9	95,2
MC222X5319	108,4	108,3	89,2	108,5	117,6
MC6634X5319	107,0	106,2	90,3	107,1	114,5
MC201X5319	98,1	104,6	91,4	105,2	103,1
MC5140X5314	98,9	102,4	96,4	103,3	101,1
MC5332X5314	93,7	99,5	98,8	99,6	93,2
MC5524X5314	99,2	97,8	100,6	97,7	96,9
MC222X5314	98,3	94,9	108,0	93,7	92,0
MC6634X5314	103,2	104,9	93,0	106,5	109,7
MC201X5314	115,8	110,0	96,4	112,0	129,5
MC5140X4499	109,4	102,8	92,8	103,8	113,6
MC5332X4499	93,0	107,7	89,2	109,0	101,2
MC5524X4499	109,4	102,4	101,1	102,9	112,5
MC222X4499	105,8	105,0	96,7	106,0	112,1
MC6634X4499	95,2	105,7	91,9	107,6	102,3
MC201X4499	108,1	102,7	99,8	108,9	117,6
MM4X5319	108,7	111,1	99,0	113,0	122,6
MM4X5314	106,0	101,9	94,4	102,9	108,9
MM4X4499	100,2	103,1	94,0	103,3	103,4
GD 5%	8,6	7,7	14,7	8,6	9,1
GD 1%	9,9	10,2	19,5	12,7	10,8
GD 0,1%	11,7	13,2	25,1	16,3	12,2
P%	4,66	3,09	6,09	3,79	11,89

With regard to the attack of the economically important fungal disease cercospora is presented in Fig.

The average values for the standard for attack by the disease reported in rating are 3.99. The tested hybrids with respect to this disease show a value of 4.34 rating, which is an excess of 8.8% compared to the standard. The highest resistance is found in pollinator 9661R, where the value is 4.51 rating.

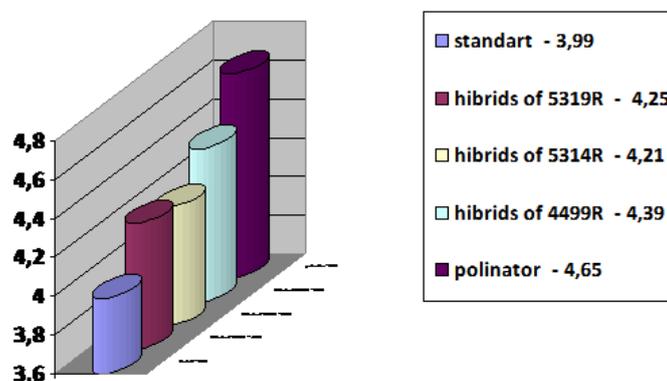


Fig1. Attack of cercospora

Here the excess in relation to the standard is 6.1%

From the conducted research work one can draw the preliminary conclusion that the hybrids tolerant to Rhizomania in the absence of the disease show higher resistance to cercospora.

The climatic conditions in the years of testing under natural conditions gave the opportunity to evaluate the rate of rotting root crops. These results are shown in fig 2.

The percentage of rotting roots in the group standard for the period of the research is 12.3%. In reviewing the data for the investigational rotting roots in the tested hybrids and parental forms it was found that the decay in the roots of the rootstocks of the tolerant to Rhizomania hybrids was proved lower than that of the standard

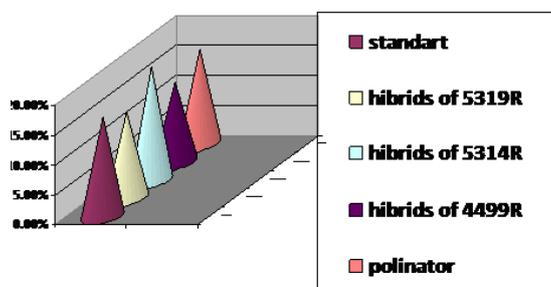


Fig2. Rotten roots %

It was found that the average of the tested new hybrids tested exceeded the extraction of white sugar the group standard by 6.7%.

4. CONCLUSIONS

The hybrids tolerant to Rhizomania in the absence of the disease show higher resistance to cercospora.

It was found that the decay of root crops in the tolerant to Rhizomania hybrids of is proved lower than that of the standard.

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