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RESEARCH ARTICLE

ASSESSMENT OF THE SELECTION MATERIALS OF SALAD BEET FOR THEIR REACTION TO THE AGENTS CAUSING FUSARIUM AND SCAB ROOT DECAY

Svilen Raykov and *Krasimira Tanova

Episkop Konstantin Preslavski, University of Shumen, Shumen

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ABSTRACT

During the period from 2012 – 2014,in the proving grounds of the Agricultural Institute – Shumen, has been performed an assessment of the selection forms of sugar beet to the agents causing fusarium rotting and scab root decay. The assessment is performed under field conditions in natural infectious background, with block method attempts, in 4 successions and with size of the cultivation area – 10.8 m2. The disease spreading is recorded and shown in % of sick plants per unit of area (ha). In the test are included 8 selection materials of sugar beet, among which there is 1 sort fodder beet for standard during the examination – the sort "Pliska". It is found that this sort is sensitive to the "root decay"; the sorts "Radost2" and 'Radost3", as well as the selection lines 802-41Red are averagely sensitive towards the "root decay" ; the sort "Radost1" and the lines 803 Red, 802 Red, 804- Yellow and 805-Yellow are averagely stable towards the "root decay" .

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INTRODUCTION

The root decay during the vegetation period of the sugar beet is periodically shown in the sowings in the area of spreading of this culture, and the most common consequences from this are the highly lowered productivity and quality, which is an economic risk for the branch (Alchovskaya *et al.,* 1987, Tanova, 2003). The diseases of the root system of the agricultural products, including the root diseases of the sugar beet, are from microbial ecological type. They are considered as a pathological syndrome from the combination of several pathogens and most often they are soil – inhabiting microorganisms, with the necessary pathological activity (Naidenov *et al*., 2001). Due to this fact, the etiology of the root decay is specific and complicated.

According to Tanova (2003), a complicated complex of microorganisms causes the root decay in the sugar beet and the most aggressive pathogen determines the type of root decay. According to some authors, the kinds of soil fungi from the genus Fusarium attack the beet even before the root formation, but the symptoms are shown under certain combination of favourable for each kind environment factors (Toporovskaya, 1985). The fusarium rotting is expressed in tail decay from the central strand and is well expressed mucoid tracheitis.

Corresponding author: Krasimira Tanova,
Episkop Konstantin Preslavski, University of Shumen, Shumen

From all sick plants, the most commonly isolated plant is the Fusarium oxysporum (Bouchot, 1983), and the disease is highly provoked by moderate humidity and temperatures from 22 to 30^{0}C. Under the conditions of a dry and hot climate, the soil pathogen Rhyzoctonia solani predominates in the root decay complex in the sugar beet (Tanova and Raykov, 2008). Usually the complex of agent causing the root decay in the sugar damages the root system of other cultures as well, which have similar to the sugar beet sowing rotation, which ion the other hand is a prerequisite for favourable conditions for infection accumulation in the soil. This additionally complicates the right strategy for root decay control. Most of the researches in the field are categorical that the chemical control is restricted and ineffective (Varbanov *et al*., 2001).

According to some researchers, the only applicable variant of the chemical method is the pre – sowing treatment of the seeds (Martin *et al*., 1984). According to Varbanov *et al*.(2001), the method is highly effective when combined with fungicidal combination with different active substance, given the complex activity of the pathogen. Due to the controversial effect of the chemical control and the necessity of ecological control of the agrosystems, the search and application of alternative control measures is necessary. In the contemporary integrated and biological systems for agriculture the usage of the sort stability as measure disease control is naturally imposed and it is related, to e greater extent, with the soil – inhabiting pathogens (Tanova *et al*., 2014).

The aim of the present examination is the test of the selection materials of sugar beet according to their stability to the agents causing the root decay - *Fusarium oxysporum u Rhyzoctonia solani*.

MATERIALS AND METHODS

The examinations are performed in the Agricultural Institute – Shumen, during the period from 2012 – 2014. The assessments are performed under proving ground conditions in natural infectious background. The recordings for the disease spreading are performed during the three phenophases from the disease development – "root formation", "root ripening" and "commercial ripeness". During the examination with parcel testing with block method in 4 succession and parcel size 10.8m^2 are included the following selection materials: 8 selection materials - line, cross – fertilizations and one sort fodder beet for standard for the recordings, showing satisfactory complex stability to the main beet diseases – the sort "Плиска" (Tanova *et al*., 2014). For recording the development of the root decay are used two – grading scales: 4 grading scale for the root decay during the "root formation" and 5 grading scale for the root decay during the phases " root ripening" and "commercial ripeness" (Tanova, 2003). The infection index for the root decay is calculated on the formula of McKinny :

R= ∑(a.b).100/N.K, where:

R- infection index in %; ∑(a.b)- amount of the products of the number of sick plants and the corresponding grade of infection according to the grade scale; N- total number recorded plants; K- the highest grade from the recording scale.

Meteorological Conditions

The available climatic data for the area of Shumen during the examination period give reasons for proving the occurrence and development of specific kinds from the complex of the agents causing the root decay in the beet.

The temperature factor and the certainty for precipitations involves predominant development of the fusarium root decay (*Fusarium oxysporum*), and during the first year of examination - of the scab root decay as well (*Rhyzoctonia solani*), due to the certainty for precipitations for the period IV-IX, which gives the pathogen the ability to activate itself.

Table 1. Precipitation in 2012 -2014 (mm)- standard for period of 50 years (IV-IX) - 310mm

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Monthly value IV-IX
2012	45	44	23	45	79	73	61	69	9	85	80	20	336
2013	108	46	6	64	145	29	33	40	16	54	27	145	327
2014	49	80	57	37	56	142	54	30	-	-	-	-	319
Average	67	57	29	49	93	71	49	46	8	46	36	55	327

Table 2. Temperature in 2012-2014(C°)- standard for period of 50 years (IV-IX) - 19.5^{0}C

Години	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average monthly value IV- IX
2012	-0.3	0.1	5.6	9.4	15.4	19.6	23.2	21.5	19.5	9.5	12.2	20.9	18.1
2013	-1.1	-3.9	6.3	13.5	18.3	22.1	28.1	23.9	19.3	15.2	8.2	-0.3	17.6
2014	1.5	2.7	6.7	12.3	18.6	21.6	21.6	24.5	20.4	-	-	-	19.8
Average	0	0	6.2	11.7	17.4	21.1	24.3	23.3	19.7	-	-	-	19.5

RESULTS AND DISCUSSION

The results from the recordings for the reaction of the examined selection materials of salad beet to the root decay disease (*Fusarium oxysporum+ Rhyzoctonia solani*) for the period from 2012 to 2014 are shown in table 3 2012- 2014. According to the data from the assessments, the average spreading of the root decay for the period for the standard sort "Плиска" is – 5.8%/ha – this value is close to the value recorded during the first year of examination.

Table 3. Results from recording the root decay spreading (*Fusarium oxysporum+ Rhyzoctonia solani*) for selection materials of salad beet for the period from 2012 to 2014

Variants	Spreading % sick plants/ ha-2012			Spreading % sick plants/ ha -2013			Spreading % sick plants/ ha -2014.				Stability
	Root phase	Root ripening phase	Commercial ripeness phase	Root phase	Root ripening phase	Commercial ripeness phase	Root phase	Root ripening phase	Commercial ripeness phase	Averagely for the period	
Pliska -Standard	0.7	2.7	5.7	7.5	8.4	8.7	6.6	6.5	6.2	5.8	S
Radost1	1.4	4.5	1.3	0.2^{000}	1.2^{000}	2.5^{000}	2.8^{0}	2.9^{0}	2.1^{0}	2.1^{0}	MR
Radost2	1.8	3.4	3.8	3.8^{00}	4.5^{0}	3.5^{000}	3.5	3.2	3.5	3.4	MS
Radost 3	1.3	4.3	2.3	2.9^{000}	3.4^{000}	2.2^{000}	2.6^{0}	2 .5^{0}	2.3^{0}	2.6	MS
803 Red	0.5	3.7	2.7	2.6^{000}	2.2^{000}	2.7^{000}	2.7^{0}	2.4^{00}	2.5	2.4^{0}	MR
802 Red	0.6	0,4	1,3	2.2^{000}	2.3^{000}	2.8^{000}	2.7^{0}	2.4^{00}	2.3^{0}	1.9^{00}	MR
802-41Red	1.0	0.6	2.4	3.2^{00}	3.5^{000}	2.5^{000}	3.6	3.3	3.4	2.6	MS
804- Yellow	1.3	0.2	0.7	0.5^{000}	0.1^{000}	0.7^{000}	1.8^{000}	1.6^{000}	1.8^{00}	0.5^{000}	R
805- Yellow	0.8	0.3	0.2	0.2^{000}	1.6^{000}	1.8^{000}	1.7^{000}	1.8^{000}	1.7^{00}	1.1^{00}	MR
GD 5 %	7.2	2.3	2.1	1.4	3.7	2.7	3.5	3.0	3.8	2.8	
P %	4.1	4.3	3.6	3.8	4.0	4.6	4.2	4.1	4.4	4.6	

Легенда : *I- immune; MR- averagely stable ; R- stableness ; MS- average sensitive; S- sensitive; ^{0}- proved first rank diversion from the standard ; ^{00}- proved second rank diversion from the standard; ^{000}- proved third rank diversion from the standard*

During this year the tested selection materials' reaction is close to the standard's reaction. During the period from the vegetation to the beet harvesting have not been recorded any diversions from in the infection index for the root decay and has been recorded relatively low infectious background in all examined selection materials. During the second year of recording, there is a clearly lowered infection index in the selection lines in relation with the standard sort in all phenophases of the vegetation. The disease has spread equally strong in both forms of the root decay. During the last year of the testing the recorded values of the infection index for the root decay show that the disease preserves its tendency for stronger development in the standard sort and lower development in the tested selection line of salad beet. The systematized results from the recordings during the period of examination showed that for the sort "Radost1" and the lines 803 Red, 802 Red, 804- Yellow and 805- Yellow, the infection index for "root decay" is with values lower than the calculated ones for the sort "Плиска".

According to the standards for stability of the National Variety Committee, the line 805- Yellow is assessed as stable to "root decay" R). The rest of the selection materials are assessed as averagely stable (MR) – the lines 803 Red, 802 Red and 805-Yellow; the sort "Radost1", or averagely sensitive (MS). Such are the sorts "Radost2" and "Radost3" and the line 802-41 Red. The standard sort "Плиска" is assessed as sensitive (S) to the "root decay". These results can serve as information for the producers of biological products, for which these culture is priceless as healthy food. It has beneficial effect on the soil improvement, acting as firming culture in the sowing rotation, and the plant waste can be used for compost producing (Pachev *et al*., 2010).

Conclution

As a result from the made recordings and observations, we can draw the following conclusions:

The sort "Pliska" shows sensitivity to the "root decay".

The sorts "Radost2" and "Radost3", and the selection line 802-41Red are averagely sensitive to the "root decay".

The sort "Radost1" and the lines 803 Red, 802 Red, 804-Yellow and 805- Yellow are averagely stable to the "root decay".

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