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Development of Root Rot In Natural Infection Background

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Abstract

The development of root rot and the frequency of rhizoctonia root rot occurrence in a natural infectious background in sugar, fodder and salad beet. The study is conducted in the period 2011-2014, in the experimental field of Agricultural Institute in the city of Shumen. The spread of rhizoctonia root rot and the frequency of occurrence of rhizoctonia root rot cause are stronger in years with rainfall above the norm.

Of three types of beet, sugar beet is most sensitive to root rot and to the cause of Rhizoctonia root decay - *Rhizoctonia solani Kuhn.*

Key words: *root rot; Rhizoctonia root rot; sugar beet; fodder beet; salad beet.*

Introduction

Root rot in beet is caused by complex soil microorganisms. Most often from this complex are isolated pathogenic fungi of *Fusarium- F. oxysporum F. solani* genus (Bouchot, 1983; Tanova., 2002), species of *Alternaria – Al.alternatae* genus (Royk and Nurmuchamedov, 2002), the cause of Rhizoctonia root rot - *Rhizoctonia solani Kuhn* fungus (Toporovskaya,1985) and of sclerotinia root rot- *Sclerotinia sclerotiorum* (Srivastava , 1996). For the conditions of Bulgaria, the most common species of *Fusarium* genus, which cause root rot in beet, is isolated the fungus *F. oxysporum* (Petrova et al., 1997), and the causative agent of thizoctonia root rot - *Rhizoctonia solani Kuhn* (Tanova., 2002; Tanova and Raykov, 2008). Root rot in sugar beet, regardless of its etiology is highly injurious and on practice it causes damage through the growing season of sugar beet (Engelkes et al., 1992). Previous studies show that soil fungus Rhizoctonia solani Kuhn appears as a cause of "slaughtering" (Alchovskaya and Zagursky,1985; Petrova et al., 1997), root rot and brown rot of the root during the vegetation and storage of sugar beet (Engelkes et al., 1992; Tanova., 2002; Toporovskaya,1985). This cause has a high degree of harmfulness under extreme climatic conditions and physiological stress sometimes triggered by poor farming practices and technological gaps (Royk and Nurmuchamedov, 2002).

Harmfulness of rhizoctonia cause of root rot in sugar beet shall be expressed in reducing productivity and quality deterioration (Tanova , 2002; Tanova, 2003). The symptoms of rhizoctonia root rot in our country were seen in fodder beet, which was confirmed by cross-infections with isolates from both cultures and comparative description of the symptoms manifested (Tanova, 2003; Tanova and Raykov, 2008).

Due to inadequate efficacy of anti-fungal agents to limit rhizoctonia rot during vegetation, the possibilities of selection methods for disease control are explored (Kikindonov, 2003; Royk and Nurmuchamedov, 2002). In our country the recommendations in this regard are for using pollinators in heterosis selection of diploid sugar beet lines.

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According to the reported results of these studies pollinators combine good field resistance to root rot with high productivity and technological qualities. To successfully limiting of rhizoctonia root rot in beet there is necessary an information on the occurrence and progression of the disease and the factors by which they are influenced (Uchkunov et al., 2015). Reported results in our country of the epidemiology of rhizoctonia root rot in beet are inadequate and do not give a complete picture of its prevalence. This study aims tracing the emergence and development of root rot in sugar, beetroot and beet salad with agro-climatic conditions of Shumen region and determining the frequency of rhizoctonia root rot.

Material and methods

Field researches

Researches and readings are for the period 2012-2014, in agro-climatic conditions of Shumen region. Researches have a natural infectious background, in the experimental field of Agricultural Institute in the city of Shumen. The experimental plots have a size 10.8 m^2, randomized according to block method, in four repetitions. The experiment variants are sugar beet plants (Elite variety), fodder beet (Vesi variety) and salad beet (Radost 3 Variety). 200 plants in phenophase of crops development „root maturation" and „technical maturity" are reported of each variant. The spread of the disease is reported by the formula:

P= A.100/ N, where: P- % sick plants; A- number of reported sick plants; N- number of reported plants. Average weighted % sick plants is re-calculated in terms of unit area - % sick plants per 1 ha.

Meteorological Conditions

Temperature conditions during the study favored the later occurrence of root rot in three cultures. The temperature factor and assurance with rainfall mainly involves the development of fusarium rot (*Fusarium oxysporum*), and in the first year of study of rhizoctonia root rot (*Rhyzoctonia solani*) too, due to the availability of the best amount of rainfall during IV-IX, which give the possibility of activating the pathogen.

Table1. Precipitation in 2012 -2014 (mm)- standard for period of 50 years (IV-IX) - 310mm

Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Monthly amount IV-IX
2011				60	48	52	45	75	21	90			391
2012				45	79	53	61	29	9	85			361
2013				64	145	29	33	0	0	14			285
2014				37	56	142	54	30	0	0			319
Average				52	82	69	48	34	8	47			339

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Table2. Temperature in 2012-2014(C°)- standard for period of 50 years (IV-IX) - 19.5^{0}C

Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average monthly amount IV- IX
2011			11.2	16.9	16.5	23.5	22.0	18.4	9.0			14.4	
2012			9.4	15.4	19.6	23.2	21.5	19.5	9.5			16.8	
2013				13.5	18.3	22.1	28.1	23.9	19.3	15.2			20.05
2014				12.3	18.6	21.6	21.8	24.5	20.4	15.8			19.3
Average			11.6	17.3	19.9	24.2	22.9	19.4	12.3			19.5	

Laboratory researches

To isolate the cause of rhizoctonia root rot *Rhizoctonia solani Kuhn* standard laboratory methods are used. For isolation and cultivation of the pathogen water agar (WA) and Chapek media (CM) are used (Tanova, 2003). The cause is isolated from plant samples, taken in root extractions in phenophase „technical maturity". The frequency of occurrence the isolated colonies of the pathogen in the association of microorganisms in diseased roots is reported in %, by the formula:

$F= A_I \times 100/A_t$, where : F-Frequency of *Rhizoctonia solani Kuhn* occurrence in % ; A_I- Number roots from which the pathogen is isolated; A_t –Total number roots with rot signs.

Results and discussion

The results of observations and reporting for the occurence and spread of the disease in sugar beet, beetroot and salad beetroot in the years of study are shown in Table 3. The time of occurrence of root rot is different over the years for each crop. Differences were found and between the cultures in each of vegetations.

Depending on the reporting year in sugar beet root rot is reported in the period 23.06-07.07. In fodder beet the disease symptoms appear, on average over the period 27.06-12.07.,i.e. with about 4 days later, compared to sugar beet in the same climatic conditions. In salad beet root rot is reported for the period 30.06- 15.07. It is 7-8 days on average later than the appearance in sugar beet and with 3 days on average for the period later than the symptoms occurrence in salad beet.

The time of the first signs give priority in the distribution of root rot in sugar beet where it was registered at the earliest. In this culture spread of root rot varied over the years from 32.0% to 45%. Most strongly spread of the disease in sugar beet was reported for the first year of the reporting period, 45%, and the lowest in 2013. In beetroot crop spread of root rot ranged from 26.5% to 36.5%, the most strongly in the first year of the study and least over 2013 years. In beet salad spread of root rot in the range of 15.6% to 22.8%, is reported, as the

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tendency for most strongly spread in the first year and the lowest in 2013 is retained in this culture.

Table 3
Development of root rot in beet - Shumen- 2011-2014

Years	Sugar beet (Elit variety)		Frequency of Rh.solani-occurence %	Fodeer beet (Vesi variety)		Frequency of Rh.solani-occurence%	Salad beet (Radost3 variety)		Frequency of Rh.solani-occurrence %
	Date of occurence	Spread in %		Date of occurence	Spread in %		Date of occurence	Spread in %	
2011	23.06	45.0	15.8	27.06	36.5	13.8	30.06	22.8	11.7
2012	30.06	37.3	12.6	5.07	30.2	11.4	9.07	20.0	11.2
2013	5.07	32.3	11.0	9.07	26.5	9.3	13.07	15.6	8.4
2014	7.07	34.0	10.5	12.07	28.0	10.7	15.07	17.0	7.5

The frequency of occurrence of the cause of rhizoctonia root rot *Rhizoctonia solani Kuhn*, calculated at the end of vegetation for all crops is highest during the first year of the study, as depending on the culture its value ranged from 11.7% to 15.8%. In vegetation 2011 the frequency of occurrence of the cause of rhizoctonia root rot is highest for sugar beet, and the lowest - in salad beet. In 2012 this trend continues as the highest frequency of occurrence is marked for sugar beet - 12.6% and the lowest for salad beet - 11.2%. In 2013 also is recorded the most highly spread of root rot and most powerful frequency of rhizoctonia root rot in sugar beet, and the lowest frequency they manifested in salad beet. In this vegetation root rot in three cultures has the lowest intensity for the reporting period. Although the calculated values for the frequency of the cause of rhizoctonia root rot are low for all three cultures, they are not the lowest for the period of study. In 2014 are reported the lowest values for the frequency of pathogen *Rhizoctonia solani Kuhn* regardless of the type of culture. The values calculated for this parameter are in the range 7.5% to 10.5%, and again the highest value is for sugar beet. The results for the spread of root rot, as well as the frequency of rhizoctonia rot show that the time of their appearance depends on climatic conditions and especially rainfall amount - at most for the period-391mm. During this year, defined as “wet” with rainfall above normal, the highest values for spread of root rot were recorded, in comparatively optimal conditions for beet vegetation (Tables 1 and 2). In reference to climate data for 2013 and their comparison with reported data spread of root rot, there is an evident for three types of cultures that in terms of rainfall below normal, the disease manifests the least. Reported stronger distribution of root rot and the frequency of rhizoctonia root rot in sugar beet, compared to the other two types of beets can be explained with the biggest amount of sugars in root crop of this culture, making it better nutrient media for the causes of root rot (Royk and Nurmuchamedov, 2002).

Conclusions

As a result of research done, follow the conclusions:

Spread of root rot and frequency of cause of rhizoctonia root rot occurrence in beet is stronger in years with rainfall above the norm.

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From three types beet, sugar beet is the most sensitive to root rot and to the cause of rhizoctonia root rot - *Rhizoctonia solani Kuhn.*

Conclusion

In conclusion we can say that the results are addressed to farmers. They may on the basis specific conditions provide correct time of harvest beet to avoid the risk of losses in productivity and quality. In the cases of simultaneous cultivation of two or three species of beets can be estimated the harvesting based on the risk and intensity of root rot.

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