PLANT PROTECTION AND STORAGE PRODUCTS

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BLIGHT – A LITTLE-KNOWN DISEASE OF SOY IN KAZAKHSTAN

Research article

Abstract

For the first time, the causative agent of late blight Phytophthora megasperma Drech. in Kazakhstan found on soybean crops in 2015. It is a quarantine disease. The article provides data on the spread of the disease, describes the symptoms of late blight soy. The frequency of the development of the disease depending on weather conditions has been established, the parasitic kind of the pathogen in Kazakhstan has been identified and biological features have been studied. The source of infection of the disease are plant debris, soil and seeds. All biotic and abiotic factors that weaken plants predispose them to infection. For sowing, only healthy seed material should be used, since the causative agent of late blight hibernates in infected seeds. Timely implementation of agricultural practices during the growing season contributes to the good development of plants, thereby increasing their resistance to the disease. Reduced degree of late blight also with a rarer plant standing. So, in the experiments, when sowing of rows between rows of 60 cm of soybean lesions by late blight was performed, it decreased by 7.7%. Chemical measures for the control of late blight have been developed. Studies on the use of contact and systemic fungicides against late blight soy show that all using drugs inhibit the development of late blight. The most effective fungicides were ridomil and metalaxyl, where their biological effectiveness was 30.7-47.3%. The zoned and promising varieties and hybrids of local and foreign soybean breeding are evaluated for disease resistance. Varieties and hybrids immune to the disease have not been identified. Resistant to late blight French varieties Dicabit.

Keywords: late blight, soy, distribution, symptoms, fungicides, pathogen, varieties, assessment, control measures, agrotechnical, chemical.

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ФИТОФТОРОЗ – МАЛОИЗВЕСТНОЕ ЗАБОЛЕВАНИЕ СОИ В КАЗАХСТАНЕ

Научная статья

Аннотация

Впервые возбудитель фитофтороза Phytophthora megasperma Drech. в Казахстане обнаружен на посевах сои в 2015 году. Оно является карантинным заболеванием. В статье приводятся данные о распространении заболевания, описаны симптомы фитофтороза сои. Установлено периодичность развития болезни в зависимости от погодных условий, идентифицирован паразитирующий в Казахстане вид возбудителя и изучены биологические особенности. Источником инфекции заболевания являются растительные остатки, почва и семена. Все биотические и абиотические факторы, ослабляющие растения, предрасполагают их к заражению. Для посева должен использоваться только здоровый семенной материал, так как возбудитель фитофтороза зимует в зараженных семенах. Своевременное проведение агротехнических приемов в период вегетации способствует хорошему развитию растений, тем самым повышая их устойчивость к заболеванию. Уменьшения степень поражения фитофторозом также при более редком стоянии растений. Так, в опытах, когда, был проведен посев междурядий 60 см поражения сои фитофторозом уменьшилось на 7,7%. Разработаны химические меры борьбы с фитофторозом. Результаты исследований по использованию контактных и системных фунгицидов против фитофтороза сои показывают, что все использующие препараты сдерживают развитие фитофтороза. Наиболее эффективными фунгицидами оказались ридомил и металаксил, где биологическая эффективность их составила 30,7-47,3%. Дана оценка районированным и перспективным сортам и гибридам местной и зарубежной селекции сои на устойчивость к заболеванию. Иммунных к заболеванию сортов и гибридов не выявлено. Устойчив к фитофторозу французский сорт Дикабит.

Ключевые слова: Фитофтороз, соя, распространение, симптомы, фунгициды, возбудитель, сорта, оценка, меры борьбы, агротехнические, химические.

1. Introduction

Soy is a valuable leguminous crop. Its seeds contain 25% fat, which has high nutritional quality, 50% protein, as well as vitamins and minerals [1], [2]. It is widely used as food, feed and industrial crops. Soya is a new culture in Kazakhstan, cultivated since 1980. In recent years, the area occupied by it has increased dramatically. Today, its sown area is about 140 thousand hectares [3]. However, the yield of this important crop in the republic is still low. It belongs to the number of crops heavily affected by harmful microorganisms. Among which are typical saprophytes, facultative pathogens, and obligate parasites. The latter include a potentially dangerous pathogen of soybean late blight - the lower fungus Phytophthora megasperma Drech var. sojae hilded order peronosporales. The disease occurs in Canada, Italy, USA, England, Ireland. In Russia, late blight was registered in the 80s in the Amur Region [4].

2. Materials and research methods

The prevalence of the disease was established by routine examinations of soybean crops in the farms of Enbekshikazakh, Talgar, Eskeldinsky, Koksu, Sarkand, Karasai districts of Almaty region. The causative agent of late blight was carried out during the entire growing season from material collected in the field according to generally accepted methods of [4], [5]. The assessment of the susceptibility of soybean varieties and hybrids by late blight pathogen was carried out on natural and infectious backgrounds. Experimental studies to identify agrotechnical and chemical measures for the development of soybean late blight (precursors, methods of sowing, varieties, fungicides) were carried out in stationary experiments of the Kazakh Research Institute of Agriculture and Plant Growing. The experiments were laid on sierozem soil. The size of the plots is 25 square meters. m. Repeatability of three and four times.

Late blight for Kazakhstan is subject to external quarantine. In Kazakhstan late blight pathogen, which is Phytophthora megasperma Drech; discovered by us in 2015. The disease was noted on Zhalpak – Saz and Tazhin varieties in the Admatinskaya oblast. The defeat of crops of soybean variety Tazhin reached 17%.

Judging by the harmfulness, this disease poses a great danger in the co-production of those countries where it is already widespread. The harmfulness of the disease is manifested in the death of seedlings and adult plants, a decrease in seed germination and grain yield up to 50%. The crop shortage depends on the type of soil, amount of precipitation, agricultural technology and variety stability. Soybean is more affected in heavy and mechanically soils and poorly drained. Soybean crops can also be affected on lighter soils, with a heavy mechanical composition under the arable layer.

So, in 2015, the development of late blight on the leaves of the Zhalpak-Saz variety in Enbekshikazakh district reached 17.0%, and in 2016 - 3.5%. The difference in the development of the disease over the years is due to weather conditions: the summer of 2015 was more moderate and rainy especially in the second half of the growing season than in the same period of 2016. In 2017, the development of the disease was depressing, since the growing season was hot and dry with high temperatures (30-35 ^{0}C) of air, especially in the second half of the growing season. The defeat of plants of varieties Mitsulya and Karlygash was in the range of 0.5-2.0%. Focal lesion of soybeans by late blight in wet years with frequent rainfall during the growing season was also noted in the Sarkand, Kksusk and Aksu districts of the Almaty region.

Symptoms of the disease. Blight affects both individual parts of the plant - seeds, roots, shoots and leaves, beans, and the whole plant. The disease affects soybeans at any stage of plant vegetation, but the disease causes the greatest damage during seedlings, causing rotting of the roots of seedlings. In the beginning, brown rotting spots of a brown hue are formed on the main and lateral roots. The spots grow rapidly covering the entire root, as a result of which the roots die off, water exchange is disturbed, at the beginning the top of the plants withers, and then it dies. With severe damage, the underground parts of the plants completely rot and are easily pulled out of the ground. In adult plants, the disease also causes wilting. The manifestation of the disease on the leaves and stems depends on the degree of damage to the root system. Leaves are first covered with brown spots, limited by leaf veins, and later completely brown and dry. Leaf blades become brittle, easily break off. Fast growing brown spots form on the stems. With a severe defeat, the leaves fall off, and the stems die off, growth retardation and death of infected plants occurs [6].

The causative agent of the disease. We have identified the type of pathogen soybean late blight, parasitizing in Kazakhstan. A comparative study of its morphological-cultural characteristics and physiological-ecological points to the pathogen belonging to the species Phytophthora megasperma, to the order Peronosporales. The vegetative body of the fungus is located in the intercellular spaces of the affected plants. During the growing season, zoo sprang grow in drops of water. Forming zoospores or an infectious germ that invades plant tissue. The incubation period, depending on the temperature, lasts 4-7 days. There are frequent cases of the formation of sexual structures in the causative agent of late blight - oospores. Their accumulation in the soil can lead to the emergence of another primary source of primary infection. Such soils are not suitable for soybean cultivation for a long time, since the infection persists in the soil for up to 8-10 years. To reduce the development of late blight, contact and systemic fungicides were tested. Soybean plants (Zhalpak-Saz) were treated with 0.4% chomecin (cuprazan), ridomil, arceride, metalaxil and ridochomecin during the growing season, and in the control, the plant was sprayed with water. The area of accounting plots is 50 m^2, the repetition of the experiment is 4-fold.

3. Results

In order to reduce the loss of soybean crop from late blight, it is necessary to apply a complex of protective measures, which provides for agrotechnical, chemical and selection-genetic methods aimed at suppressing the disease at all stages of crop

cultivation. Based on the bioecological characteristics of the causative agent, in the fight against late blight, special attention should be paid to crop rotation, observing crop rotation, variety stability and spatial isolation of fields, and not placing soybeans after legumes to reduce the possibility of soybean infection for the next year, it is necessary to plow after-harvest residues with plows with skimmers to a depth of 20-30 cm so that the topsoil gets on the furrows. Leaves infected with late blight wintering under the soil pose a lower risk of infection, since the pathogen partially dies. The degree of late blight is also reduced with a rarer plant standing. So, in the variant with row spacing of 30 cm, late blight development was 7.7% more with row spacing of 60 cm.This is explained by the fact that, when the crops were thickened, more favorable conditions were created for the development of the disease, humidity increased under the vegetation cover. The number of affected plants in late soybean crops was 9.3%, and the degree of development was 2.7% higher than in early ones, since plants at a young age are more susceptible to this disease.

Assessed zoned and promising soybean varieties: Eureka 357, Kazakhstan 200, Hybrid 670, Merit, Karlygash, Bucuria, Boyko, Mitsulya, Evans, Talgar 5, Kazakhstan 2309, Volna, Skinteya, Khodzon, Tazhin, Mutant 350, Kazakhstan 200, Vysokostelnaya1 , High Stem 2, Sibnik, Misula, Dikabit, K-1222, K-2227, etc.) for resistance to late blight.

Among the tested varieties immune to late blight, no. However, there are differences in stability. So, relatively resistance to late blight as a result of a two-year assessment was shown - Misula 1093, the spread of the disease is 10.3-16.4%, respectively, the degree of development is 4.2-6.2; Zhalpaksai - distribution of 8.6-10.3%, the degree of development of 3.8-4.2%. The medium affected varieties include Hybrid 670, distribution 26.1-28.7%, development degree 9.2-10.6%; Kazakhstan 2309 distribution of 25.7-28.6%, the degree of development of 11.8-17.7%; Sibnik 315 - distribution 27.8-29.9%, degree of development 12.5-15.0%; Mutant 359, spread 28.4-29.6%, development degree 11.0-13.3%. The only French Dicabit variety was resistant to the disease (the spread of the disease was 5.5%, development 2.1%)

The greatest development is observed in the varieties Kazahstanskaya 200, Bucuria and Boyko, where the spread of the disease was in the range of 28.7-33.0%, and the degree of development was 17.0-18.9%.

Thus, the results of assessing the resistance of zoned and promising soybean varieties to late blight in the field showed that among them there are no absolutely stable ones. The French variety Dicabit was relatively resistant to this pathogen.

Blight on the vegetative plants of early varieties (Zhalpak-Saz and Boyko) is especially harmful. The development of the disease is caused not only by the preserved potentials of the infectious onset, but also by the weather conditions of the growing season. We found that the disease does not develop annually, but mainly in humid and cool weather (Table 1).

Table 1 – The spread of late blight in the conditions of Almaty region

№	Districts, farms	The spread of late blight, %		
		2015	2016	2017
1.	Enbekshikazakh district, KH "Turgen"	17,0	3,5	0,5
2.	Talgar district, KH "Ayyr-Shyr"	12,0	2,0	1,0
3.	Talgar district, KH them. YES. Kunaeva	1,5	0,0	1,5
4.	Karasaysky district, OPK "Kaskelen	16,7	0,5	33,0
5.	Sarkand district, PK "Zhas Talap"	2,5	0,0	0,5
6.	Koksu district, PC Enbekshi	5,0	0,0	0,0
7.	Eskeldinsky district, PC them. N. Aldabergenova	1,0	0,0	0,5

The test results of contact and systemic fungicides against late blight soy are shown in Table 2.

Table 2 – The effectiveness of fungicides against late blight soy

Fungicides	Rot development, %	Biological effectiveness, %	Soybean yield, cwt / ha
Control (water)	33,0	-	20.0
chomecin	29,6	10,3	20.5
readomil	22,9	30,7	20.7
arceride	27,2	17,5	20.6
metalaxyl	17,4	47,3	21.7
Ridochomecin	24,6	25,4	20.3

From the data of the table it can be seen that spraying soybean crops with the listed fungicides allowed to reduce late blight development by 3.1-9.7% compared with the control (33.0%). The best results were given by ridomil, metalaxyl (biological effectiveness 30.7-47.3%). Ridochomecin was a slight decrease in late blight development. However, it should be noted that in the wet years, the above drugs were not effective in the fight against late blight, which may require additional processing.

Processing soybean crops against late blight, promising fungicides contributed to the preservation of the crop in the range of 0.5-1.7 cwt / ha.

In the conclusion, I would like to sum up these main points:

1. Soybean late blight in Kazakhstan was registered in 2015. The greatest distribution is late blight in the foothills of the Almaty region (33%).

2. The development of soybean late blight is significantly affected by weather conditions. The disease is especially severe in the years with the highest rainfall.

3. Among the tested zoned and promising soybean varieties, there is absolutely no resistance to late blight, Dicabit is relatively stable.

4. The main source of primary infection of soybean late blight in the Almaty region are seeds and partially affected plant debris.

5. The tested contact and systemic fungicides are not effective enough against soy blight and inhibits the development of the disease only at the initial stage of plant development. The most effective fungicide in the fight against the disease in the field is Metalaxil.

Conflict of Interest

None declared.

Конфликт интересов

Не указан.

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