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THE ROOT ROTS AND GRAIN DISEASE IN WHEAT

A. F. Korshunova,
E. I. Shchekochikhina and
L. A. Makarova

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The helminthosporium and fusarium root rot in the spring grain crops is observed every year but both the degree of the damage and the type of its manifestation vary according to the weather conditions. A study of the agricultural climatic conditions of the development and occurrence of the disease showed that the chief factor determining the intensity of the infection and manifestation of the disease is the moisture conditions in the soil in the period of the vegetation of the wheat plant. A generalization of the data on the moisture supply of the wheat made it possible to segregate five groups of regions with a different degree of the injuriousness of the root rot.

The following were laid down as the basis for the segregation of the zones (groups of regions): 1) the perennial supply of productive moisture in the one-meter layer of the soil in the period of the appearance of the disease with this supply characterizing the total moisture resources; 2) the ratio of the moisture supply in the arable layer of the soil in the period of the infection of the plants to the moisture content of the one-meter layer

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in the period of the disease manifestation with this ratio characterizing the dynamics of the moisture supply in the period of the development of the wheat.

On the basis of these indices, the probability was determined of the years with a moisture supply in the period of the disease manifestation lower than the "critical" limits (60 and 1.0 mm) at which conditions are created for an injurious manifestation of the disease (Table 1)

Table 1

THE PROBABILITY OF AN INTENSE MANIFESTATION OF ROOT ROT ON THE TERRITORY OF THE VIRGIN LANDS AND ADJACENT REGIONS

(1) Группа районов	(2) Многолетние запасы влаги в метровом слое почвы в период проявления болезни (мм)	(4) Условный показатель динамики запаса влаги в почве	(7) Процент повторяемости возможного сильного проявления болезни
I	20—40	(5) Более 0,6	90
II	40—60	0,6—0,5	70
III	60—80	0,5—0,4	40
IV	80—100	0,4—0,3	20
V	(3) Выше 100	(6) Менее 0,3	10

Key to Table 1: 1) The group of the regions; 2) perennial moisture supply in the one-meter layer of the soil in the period of disease manifestation (mm); 3) More than 100; 4) The reference index of the dynamics of the moisture supply in the soil; 5) More than 0.6; 6) Less than 0.3; 7) The percentage of the recurrence of a possible intense manifestation of the disease.

Among the group I regions are most of the regions of Saratovskaya, Volgogradskaya and Astrakhanskaya oblast, of the former East Kazakhstanskiy Kray, the southern regions of Kuybyshevskaya Oblast, the western, southwestern and central regions of Orenburgskaya Oblast; among the group II regions are most of the regions of Tselinnyy Kray, the steppe regions of Altayskiy Kray, eastern regions of Orenburgskaya Oblast, a number of regions of Saratovskaya, Kuybyshevskaya, Chelyabinskaya and Kurganskaya ob-

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lasts; among the group III regions are the northern regions of Kuybyshevskaya Oblast, the western and southern regions of Bashkir ASSR, most of the regions of Chelyabinskaya, Kurganskaya and North Kazakhstanskaya oblasts, the southern regions of Omskaya and Novosibirskaya oblasts, the eastern and southeastern regions of Altayskiy Kray, the northwestern regions of Kustanayskaya Oblast and the northern regions of Kokchetavskaya Oblast; among the group IV regions are most of the regions of Bashkir ASSR, the northern regions of Chelyabinskaya Oblast and the central regions of Omskaya, Novosibirskaya, Kemerovskaya and North Kazakhstanskaya oblasts; among the group V regions are the northern regions of the territory indicated.

In the regions of an insufficient or uncertain moistening, characterized by a reference index of the dynamics of the moisture supply in the soil of from 0.6 to 1.0 the fungus Helminthosporium sativum P. K. et B. causes the usual root rot. In the regions with a sufficient moistening or in the years with an excess of the average perennial amount of precipitation the fungus more often causes a grain disease of the "black embryo" type.

In 1964 a mass attack of the crops by root rots was observed in the south of Krasnoyarskiy Kray (Table 2) and in North Kazakhstanskaya Oblast (up to 70% of diseased plants).

In Altayskiy Kray the root rots appeared chiefly in the sprouts causing a thinning-out of the grass stand by 7%. In the period of the waxy stage of maturity of the grain the empty heads amounted here to 4%. A similar attack was observed in Chelyabinskaya, Kokchetavskaya and other oblasts of Western Siberia. In doing so, the hard wheats were affected

Table 2

THE ATTACK OF SPRING WHEAT BY ROOT ROT
IN KHAKASS AUTONOMOUS REGION

(1) Хозяйство	(7) Площадь пораженных посевов (га)	(8) Процент пораженных растений	(9) Процент развития болезни
(2) Колхоз: «Знамя Коммунизма»	1100	50—70	15—22
(3) им. Ленина	370	25—60	25—36
(4) Совхоз: «Московский»	2185	60—83	28—49
(5) «Алтайский»	900	78	22—35
(6) «Борец»	584	69	29—32

Key to Table 2: 1) The farm; 2) Kolkhoz "Znamya Kommunizma; 3) Kolkhoz imeni Lenin; 4) Sovkhoz "Moskovskiy"; 5) Sovkhoz "Altayskiy"; 6) Sovkhoz "Borets"; 7) The area of the affected crops (hectares); 8) The percentage of the affected plants; 9) The percentage of the development of the disease.

more extensively (15-17%) than the soft wheats (6-7%). But on the greater portion of the territory on which the spring cereals were cultivated the conditions in the period of the vegetation were favorable for the development of the plants and in spite of the wide spread of the root rot it was of no material significance (Table 3).

However, a large reservoir of infection in the soil and also a high and excessive amount of precipitation in the period of the wheat ripening and harvesting caused in a number of the country's oblasts a severe infection of the grain with helminthosporium disease. Thus, in Siberia (Novosibirskaya, Kemerovskaya, Kustanayskaya and Karagandinskaya oblasts, and Altayskiy and Krasnoyarskiy krays) and also in the separate regions of Volgogradskaya Oblast the grain disease reached 50% and more. In Chelyabinskaya Oblast, separate lots of the hard winter wheat had up to 60% of infected grain. A deterioration of its quality and a sharp decline of the germination rate were observed because of this (Table 4). For example, in Novosibirskaya Oblast, separate lots of the grain of the varieties Skala

Table 3

THE ATTACK OF SPRING WHEAT BY ROOT ROT

(1) Республика, область	(9) Площадь пораженных посевов (га)	(10) Процент пораженных растений	(1) Республика, область	(9) Площадь пораженных посевов (га)	(10) Процент пораженных растений
(2) Саратовская обл.	4 100	1—18	Омская обл. (6)	2 720	6—27
(3) Оренбургская обл.	41 921	1—10	Читинская обл. (7)	7 647	1—30
(4) Тюменская обл.	9 479	4—10	Тувинская АССР (8)	650	1—17
(5) Павлодарская обл.	1 100	1—5			

Key to Table 3: 1) Republic or oblast; 2) Saratovskaya Oblast; 3) Orenburgskaya Oblast; 4) Tyumenskaya Oblast; 5) Pavlodarskaya Oblast; 6) Omskaya Oblast; 7) Chitinskaya Oblast; 8) Tuva ASSR; 9) The area of the attacked crops (hectares); 10) The percentage of the attacked plants.

Table 4

THE DATA OF THE ANALYSIS OF THE SPRING WHEAT SEEDS (VIZR /ALL-UNION PLANT PROTECTION INSTITUTE, 1964/7

(1) Сорт	(11) Процент проросших семян		(14) Процент непроросших семян		(17) Процент больных семян, пораженных грибами		
	(12) с нормальной всхожестью	(13) с ослабленной всхожестью	(15) здоровых	(16) больных	(18) гельминтоспориозом	(19) фузариозом	(20) плесенью
(21) Кемеровская область							
(2) Скала	64,0	12,5	2,0	21,5	100	—	—
(3) Цинмант	69,7	10,0	4,2	25,7	100	—	—
(4) Саратовская 29	44,0	10,0	5,0	41,2	85	15	—
(5) Лютесценс 751	42,0	14,5	4,0	39,5	82	18	—
(22) Иркутская область							
(6) Народная	53,5	11,7	21,3	13,5	63	19	18
(23) Кустанайская область							
(7) Кустанайская 14	48,0	16,5	19,0	17,5	74	26	—
	37,7	17,0	35,7	9,6	75	12	13
(24) Карагандинская область							
(8) Образец: 2291	71,0	5,2	10,5	13,3	56	14	30
2287	63,2	10,6	12,5	13,7	36	26	38
2306	43,0	13,5	31,0	11,0	41	23	36
2307	34,0	29,0	5,5	11,5	57	8	35
(25) Волгоградская область							
(9) Альбидум 43	72,2	7,5	7,0	13,5	44	30	26
(10) Малянопус 1932	52,5	25,1	7,7	14,8	32	3[illegible]	3[illegible]
	51,0	25,6	4,8	18,4	90	4	6

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Key to Table 1: 1) Variety; 2) Shola; 3) Diamant; 4) Saratovskaya 29; 5) Lyutestsens 751; 6) Narodnaya; 7) Kustanayskaya 14; 8) Sample: 2291, 2287, 2306, 2307; 9) Al'bidum 43; 10) Malyanorum 1932; 11) The percentage of germinating seeds; 12) With normal shoots; 13) With weakened shoots; 14) The percentage of ungerminating seeds; 15) Healthy; 16) Diseased; 17) The percentage of diseased seeds attacked by the fungi; 18) Helminthosporium; 19) Fusarium; 20) Mold; 21) Kemerovskaya Oblast; 22) Irkutskaya Oblast; 23) Kustanayskaya Oblast; 24) Karagandinskaya Oblast; 25) Volgogradskaya Oblast.

and Diamant had a germination rate of the order of 31-32%. In a number of oblasts (Bryanskaya, Orlovskaya, Lipetskaya, Chelyabinskaya, Belgorodskaya, Kemerovskaya, etc.) and also in Belorussian SSR a considerable portion of the seeds also failed to be up to grade with respect to the germination rate and degree of infection with the fungi.

The root rots in winter wheat were caused by a number of causal organisms but chiefly by the Fusarium species F. culmorum Sacc., F. gibbosum App., etc.

Extensive reservoirs of disease were observed in the Baltic republics. For example, at the Kolkhoz imeni Menlikayte in Kedaynskiy Rayon of Lithuanian SSR the wheat stems with empty heads amounted to as much as 46% on the sections after barley. In Tartuskiy, Vyruskiy and other regions of Estonian SSR, with a slight attack on most of the sowings the diseased plants amounted to as much as 93% only in separate fields. On the farms in Krasnoslobodskiy Rayon of Mordovian ASSR the empty heads amounted to 40%. In Checheno-Ingush ASSR, owing to a severe thinning-out of the crops 7,580 hectares of the winter crops, including 2,232 hectares of wheat, were resown. In doing so, the amount of lost plants reached 40%. However, on the greater portion of the crops in European part of the USSR the disease was of no material economic significance.

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DISTRIBUTION OF THE DISEASE BY CEREOSPORELLA AND OPHIOBOLUS IN 1960 (ACCORDING TO THE DATA OF Z. [illegible] AND G. [illegible] POLYAKOVA)

Культура (1)	(3) Пораженность растений	(12) Место проведения учетов
	(7) Церкоспореллез	
(2) Озимая пшеница	10,2—32,7	С. Унятыги Дрогобычского района Львовской области (12)
	(8) До 40,0	С. Дотнуво Кедайнянского района Литовской ССР (13)
	2,7—58,0	В различных местах Латвийской ССР (14)
(3) Озимый ячмень	(9) До 6,7	Прикарпатская сельскохозяйственная опытная станция, Львовская область (15)
(4) Озимая рожь	6,1—16,9	Там же (16)
	8,1—21,9	В различных местах Литовской ССР (17)
	4,4—35,0	В различных местах Латвийской ССР (18)
	(10) Офиоболез	
(5) Озимая пшеница	4,0—31,0	Отдельные хозяйства Залского и Баксанского районов Кабардино-Балкарской АССР (19)
	0,5—17,0	Отдельные хозяйства Минераловодского района Ставропольского края (20)

Key to Table 5: 1) The crop; 2) Winter wheat; 3) Winter barley; 4) Winter rye; 5) Winter wheat; 6) The percentage of the attacked plants; 7) Cercosporella disease; 8) Up to 40.0; 9) Up to 6.7; 10) Ophiobolus disease; 11) The locality where the count was made; 12) The Village of Upyutygi in Drogobychskiy Rayon of L'vovskaya Oblast; 13) The Village of Dotnuvo in Kedaynyanskiy Rayon of Lithuanian SSR; 14) In various localities of Latvian SSR; 15) Carpatian Region Agricultural Experiment Station, L'vovskaya Oblast; 16) Ditto; 17) In various localities of Lithuanian SSR; 18) In various localities of Latvian SSR; 19) Separate farms in Zalvskiy and Baksanskiy rayons of Kabardino-Balkar ASSR; 20) Separate farms in Mineralovodskiy Rayon of Stavropol'skiy Kray.

Separate reservoirs of disease caused by a complex of causal organisms (Fusarium sp., Ophiobolus graminis Sacc., Helminthosporium sativum P. K. et B.) were observed in Sumskaya Oblast (up to 46%) and also on a number of farms in Labinskiy and Otradnenskiy rayons of Krasnodarskiy Kray (from 42 to 59%).

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Isolated cases of ophiobolus and cercosporella disease (Cercosporella herpothrichoides Fron.) with a slight degree of manifestation were encountered in North Caucasus, Ukraine and Baltic Region. Selective survey data are given in Table 5.

A mass-scale development of fusariosis on the winter wheat spikes was observed in many localities and especially in Krasnodarskiy Kray (Table 6). For example, there was a considerable attack on the farms of Labinskiy, Otradnenskiy and Pavlovskiy rayons where root rots were observed at the same time. The appearance of fusariosis on the spikes and grain was caused by the falling of a considerable amount of precipitation in the period of the grain forming and ripening.

Table 6

DATA ON THE MOST INTENSE ATTACK OF THE WINTER WHEAT SPIKES BY FUSARIOSIS IN KRASNODARSKIY KRAY

(1) Район	(10) Колхоз	(25) Обследованная площадь (га)	(26) Процент поражения колосьев
Абинский (2)	«Красное Знамя» (11)	240	48
	«Восток» (12)	370	56
Отрадненский (3)	Им. Крупской (13)	90	10
	«Путь Ильича» (14)	60	61
Лабинский (4)	Ново-Алексеевский (15)	17	65
Усть-Лабинский (5)	Им. Ленина (16)	115	49
	«Дружба» (17)	126	12
Павловский (6)	«Советская Россия» (18)	289	32
	Им. Калинина (19)	247	15
Крымский (7)	«Победа» (20)	360	27
	«Путь Ильича» (14)	100	23
Кущевский (8)	«Заветы Ильича» (21)	60	31
	«Победа» (20)	30	60
	Им. Чапаева (22)	37	21
Каневский (9)	«Россия» (23)	232	16
	«Заветы Ильича» (21)	56	4
	Им. Суворова (24)	141	2
	«Победа» (20)	96	1

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Key to Table 6: 1) [illegible]; 2) [illegible]; 3) Otradnenskiy; 4) [illegible]; 5) [illegible]; 6) Pavlovskiy; 7) Krymskiy; 8) Nurmekovskiy; 9) Kazanskiy; 10) Kolkhoz; 11) "Krasnoye Znamya"; 12) "Vostok"; 13) Kolkhoz imeni Krupskaya; 14) "Put' Il'icha"; 15) Novo-Mikhaylovskiy; 16) Kolkhoz imeni [illegible]; 17) "Druzhba"; 18) "Sovetskaya Rossiya"; 19) Kolkhoz imeni Kalinin; 20) "Pobeda"; 21) "Zavety Il'icha"; 22) Kolkhoz imeni Chapayev; 23) "Rossiya"; 24) Kolkhoz imeni Suvorov; 25) The area surveyed (hectares); 26) The percentage of the attached spikes.

A following year's yield depends to a considerable degree on the quality of the seeds. Because of this, it is extremely necessary to treat the seeds against helminthosporium and fusarium infection. It was found that after using the mercury preparations (Granosan, etc.) the extent of the infection of, for example, spring wheat grain by helminthosporium is reduced from 40% to 2% with a simultaneous increase of the grain germination rate from 59% to 92%. Treatment also has a positive effect on the field germination rate and on the density of the stand. To intensify the development of the plants in the initial period of the vegetation the seeds should be dusted with superphosphate (2 kilograms per 1 centner) before sowing.

A large reservoir of the soil and seed infection when agricultural preventive measures are not observed may lead to a mass-scale attack of the soft and especially hard spring wheats by the root rots. On the condition of normal wintering of the plants the root rots will not have a widespread occurrence in the winter wheats.