Development, spread of root rot on plowing, disking and direct sowing

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Abstract. The results of the study showed that various methods of tillage affect the population of the soil with pathogens. Less populated was the soil where traditional tillage was carried out - autumn plowing. With this treatment, in the 0-10 cm layer, the soil colonization with root rot conidia was lower than with minimal tillage and zero sowing. In the 10–20 cm layer, the same trend persisted. The presence of conidia of the genus Alternaria was observed mainly in layer 0-10; 0-20cm and was negligible. At zero sowing, the conidia in the 10-20 cm layer were mostly semi-decomposed.

1 Introduction

Tillage remains an essential element of zonal farming systems. One of the main tools for the improvement of agrocenoses is an agrotechnical method based on soil cultivation methods [1].

Recent studies have significantly expanded the understanding of the mechanism of action and the effectiveness of this direction. The use of scientifically based agricultural practices as part of integrated programs provides a fundamental and multifaceted impact on the pathogenic complex, helps optimize the phytosanitary state of agrobiocenoses, stimulates the resistance of crops to damage and damage, increases their competitiveness in relation to weeds.

Different methods of processing create different conditions that have a positive and negative value for the long-term optimization of the phytosanitary state of soils and crops. The most widely used in production, moldboard and non-moldboard tillage, in terms of the impact on the phytosanitary state of soils, cause both positive and negative processes [2, 3].

Modern technologies in soil protection tillage, on the one hand, contribute to a greater accumulation of soil microflora than in moldboard. The load of infected plant residues on the plant against these backgrounds is usually 6-9 times higher. At the same time, the largest proportion of harmful organisms (seeds, weeds, propagules of phytopathogens) is concentrated in the upper ten-centimeter soil layer, where the population of pathogens, in particular *B. sorokiniana conidia,* as a rule, exceeds the threshold of harmfulness, creating a

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critical limit for the growth and development of cereal plants in the period from seed germination to seedling emergence [4, 5].

The most important conditions for the use of phytosanitary technology are a high level of agricultural technology, a clear technological discipline in the fields, mechanized work at optimal times, etc. The technology will be effective only when a high crop culture is achieved, fertilizers and plant protection products are applied.

In the tactics of plant protection from diseases during soil protection tillage, the role of seed quality, seeding rates, compliance with the optimal depth of seed embedding, that is, those agrotechnical techniques that ensure optimal seedling density, increases. On soil-protective backgrounds, the conditions for overwintering of harmful organisms are improving, firstly, because they are subject to the protective action of plant residues, and secondly, because of the possibility of unhindered exit from wintering sites for the resumption of the life cycle.

On the other hand, with non-fallow methods of tillage, due to a significant improvement in the water regime, there is an increase in the humus content and humidity in the upper soil layer, and these indicators correlate with their long-term biogenicity and suppressiveness and, consequently, the optimization of the phytosanitary condition, since it is the humus content and optimal soil moisture that not only reduce the survival of phytopathogens, but also and they are a prerequisite for saprophytic, not parasitic nutrition of harmful organisms, reducing their harmfulness. At the same time, due to the better moisture supply and activity of the antagonistic microflora, the endurance of plants to infection increases.

The number of antagonists, or the so-called antagonistic potential of the soil and rhizosphere to pathogens, has a significant impact on the pathogen population. Especially many antagonists are noted among oligonitrophiles and actinomycetes. The number of these groups of antagonists in soil protection treatments, as a rule, is significantly higher compared to plowing. As a result, the total number of antagonists from different groups of microorganisms during flat-cut treatments approaches the natural phytocenosis of virgin or fallow lands, where a relative equilibrium of microbial associations has developed in the process of evolution, i.e. the antagonistic potential of the soil here is close to the optimal value.

The relevance and necessity of scientific support in this area are obvious, as they are fully confirmed by the critical phytosanitary situation in the country and the region, as well as the decline in crop production due to a lack of technical and fuel resources.

The basis of resource-saving technology is the minimization of tillage, the combination of operations in technological processes, the differentiated use of shallow plowing or the rejection of it, the observance of strictly dosed use of mineral fertilizers, scientifically based, differentiated use of plant protection products, etc.

The system of tillage. The main purpose of this agricultural technique is to regulate the density of the soil, promote the accumulation and preservation of moisture, the destruction of weeds, and the creation of favorable conditions for the growth and development of agricultural plants.

Constructed taking into account the biological requirements of the culture and the characteristics of pathogens, it acquires a phytosanitary function, mainly by increasing the disease tolerance of plants and increasing competitiveness against pests and weeds.

Moreover, soil preparation techniques, increasing its biogenic layer, accelerate the mineralization of plant residues, activate microbiological processes, antagonistic activity of microorganisms, lead to a decrease in the amount of infection in the soil and the accumulation of nutrients.

2 Methods and research methodology

One of the main tools for improving agrocenoses is the agrotechnical method, combined with the cultivation of resistant varieties mainly of local selection.

Recent studies have significantly expanded the understanding of the mechanism of action and effectiveness of this direction. The use of scientifically based agricultural practices, as part of integrated programs, provides a fundamental and multifaceted impact on the pathogenic complex, contributes to the optimization of the phytosanitary state of agrobiocenoses, stimulates the resistance of crops to damage and damage, increases their competitive ability against weeds.

Records and observations included: microbiological studies of rhizospheric soil and quantitative accounting of microflora - on diagnostic nutrient media.

The production experience was based on moldboard, minimum using energy-saving technology (discator - in autumn, spring - cultivator) and direct sowing with a stubble seeder.

The soil population with *B. sorokiniana* conidia was determined by the flotation method.

The production experience was laid down according to the generally accepted methodology, placed on a typical site for the zone. The soil is leached chernozem.

The experiment is based on dump (generally accepted for the zone) plowing, minimal processing, direct sowing.

3 Research results

Soil tillage is one of the main elements of zonal farming systems, which allows creating optimal soil composition, favorable water-air and food regimes, minimizing the negative impact of weeds, pests and diseases.

To study the influence of various factors on the condition of experimental crops during the entire growing season, studies were carried out to study the factors that affect plants. The preparatory stage was the study of the soil for the population of root rot with conidia. Soils were sampled in spring before sowing spring wheat and in autumn after harvesting.

Table 1. The level of soil population with pathogens of root rot under various methods of tillage (spring, germination phase).

N	Options	The level of soil population with conidia			
		layer 0-10cm. con/1g		layer 10-20cm. con/1g	
		B. sorokiniana	Alternaria	B. sorokiniana	Alternaria
1.	Plowing	120/120/100/140 120	0/0/20/0 5	60/60/80/60 65	0/20/0/0 5
2.	Disking	200/180/160/160 175	20/0/20/0/ 10	60/80/100/80 80	20/0/0/0 5
3.	Direct seeding	220/200/260/200 220	20/0/20/0 10	120/80/80/100 95	0/0/20/0 5

Table 2. The level of soil population with pathogens of root rot with different methods of tillage (autumn).

N	Options	The level of soil population with conidia			
		layer 0-10cm. con/1g		layer 10-20cm. con/1g	
		B. sorokiniana	Alternaria	B. sorokiniana	Alternaria
1.	Plowing	80/80/100/60 80	0/20/0/0 5	60/40/60/60 55	0/0/0/0 0

2.	Disking	120/120/100/140 120	20/0/20/0 10	80/100/80/60 80	20/0/0/0 5
3.	Direct seeding	200/180/160/180 180	20/20/20/0 15	100/80/80/120 95	0/0/20/0 5

In the course of the study, it was found that all the studied soils contain conidia of fungi of the genus *Bipolaris.* The data obtained as a result of the research are presented in Tables 1 and 2.

When analyzing the results, it turned out that various methods of tillage have an ambiguous effect on the development of diseases of various epiphytologies, and especially on the long-term optimization of the phytosanitary state of soils and crops.

Less populated was the soil where traditional cultivation was carried out - autumn plowing. With this treatment, in the 0-10 cm layer, the soil colonization with root rot conidia was lower than with minimal tillage and zero sowing. In the 10–20 cm layer, the same trend persisted. The presence of conidia of the genus *Alternaria* was observed mainly in layer 0-10; 0-20cm and was negligible. At zero sowing, the conidia in the 10-20 cm layer were mostly semi-decomposed.

During the autumn accounting of the soil population with conidia, it turned out that the trend was preserved.

Phytopathological mapping (PTM) is carried out to predict epiphytoties and develop methods for improving soils.

According to the level of soil population are divided:

- Below the threshold of harmfulness (TH) (the content in the soil is within 40 or less conidia per 1 g of soil). The decrease in yield in this case is not statistically significant.
- Above TH (40 - 100 conidia per 1 g of soil). The development of the disease is 10 - 15%, the prevalence is up to 60%. Moderate local epiphytoty should be expected (the disease affects a limited area, more often in isolated foci). The grain yield decreases by 8-15%, mainly due to a decrease in the density of productive stems, a decrease in the grain content of the ear and the weight of 1000 grains (3 critical periods).
- High soil population with pathogens (more than 100 conidia per 1 g of air-dry soil plus infected plant residues). The disease can occur in the form of a progressive epiphytosis. The prevalence of the disease is more than 60%, the development is more than 15%. The yield is reduced by 15 - 20% or more. The sensitivity of plants to drought increases, the positive effect on the yield of mineral fertilizers decreases.

4 Conclusion

From the obtained results, it can be concluded that the soils under the experiment belong to soils with a high pathogen population, i.e., the experiment was carried out against a high infectious background, although the population of soils with different methods of processing differs significantly.

Causes of predisposition to the disease in Siberia: a short growing season, low biological (antagonistic in relation to pathogens of root rot) soil activity, spring-summer drought - nutrient deficiency, physiological immaturity of seeds; deep embedding of seeds in the soil during sowing.

In fields with a high content of conidia of root rot pathogens, it is necessary to carry out measures aimed at improving the soil, for example, by introducing phytosanitary crops (oats,

rapeseed, buckwheat, legumes, potatoes, root crops) into crop rotations as a precursor, increasing the phytosanitary role of fallow by introducing phosphate fertilizers.

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