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Effect of Increasing Doses of Mineral Fertilizers on Development of Root Rot Pathogen Fusarium in Crops Winter Wheat.

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ABSTRACT

This article describes the biological evaluation of the effectiveness of different doses of fertilizers and the ratio of their nitrogen and potassium in relation to root rot of winter wheat on the results of observations in the 2010-2014, it was found that the most optimal from a phytosanitary point of view is the ratio of nitrogen and potassium of 1.7: 1, which allows you to keep the development of the disease within the economic threshold of harmfulness (ETH) = 1-15%.

Keywords: winter wheat, root rot, fertilizers, leached chernozem, productivity.

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INTRODUCTION

The use of phosphorus-potassium fertilizer is traditionally considered an important technique that improves the phytosanitary condition of agroecosystems [2, 8]. Increased potassium nutrition of plants allows the formation of their stronger skeletal tissues as well as cell wall and cuticle that prevents the penetration of plant pathogens inside the cell. Moreover, in the amplification process under optimal metabolic conditions potassium nutrition slows the decomposition of organic substances, so in plants no soluble carbohydrates and low molecular weight nitrogen compounds, which serve as nutrient substrate for pathogenic organisms. The conditions sufficient potassium nutrition in plants is activated biosynthesis of phenolic compounds, which play an important role in plant immunity [4, 6, 7].

There is evidence that the use of potassium fertilizers increases the resistance of many cultivated plants to oidium and mildew, root crops - to rot in storage.

On the other hand, nitrogen fertilizers, creating an excess of nitrate in the soil enhance its conductive properties, whereby not only the phytopathogenic fungi are becoming predominant, but under optimal conditions can actively infecting susceptible plants. There are cases increasing plant susceptibility to mildew and oidium when making an excess of nitrogen fertilizers.

According to V.A .Chulkina et al. (2009), with an excess of nitrates antagonists many bacteria lose their ability to produce antibiotics and other biologically active substances. Under these conditions, increases the number of phytopathogenic fungi in soil and increased damage plants root rot [1, 3, 5, 9].

But the known facts and opposite, such as increased resistance to tobacco and sunflower Peronospora for some nitrogen excess.

Thus, in each case requires an assessment of the impact of fertilizers on crop susceptibility to those and other diseases.

MATERIALS AND METHODS

Soil by experimental plot is represented leached chernozem, powerful, low humus content, heavy. It has a pretty solid build 1,15-1,31 g / cm^3. The capacity of absorption of the arable layer - 40 mg / eq. 100 g of soil. The reaction in the soil solution is an average of 6.7, which is close to neutral pH. The soil is characterized by a portion of the average humus content - 5.1-5.6%, the average mobile phosphorus - 22 mg / kg of soil, and soil potassium exchange refers to a group of high security - 240-260 mg / kg of soil. The average annual long-term total precipitation in the zone of the experiments is 623 mm and the average annual temperature is 9,2 °C. On the basis of the main agro-climatic indicators, we can conclude that the weather conditions are favorable experimental station for growing and producing stable yields of winter wheat.

The following fertilizers were used: ammophos (Ap), ammonium nitrate (An) and potassium chloride (Pc). The fertilizers were applied before planting and basic soil processing. Foregoing crop - peas. Accommodation plots method randomized reps, reps of experience 3-fold; width - 12,80 m long, the overall experience of S - 960 m^2, S accounting experience - 528 m^2.

Calculation of doses of mineral fertilizers on the planned yield of winter wheat 4.0, 5.0 and 6.0 t / ha was carried out by two methods. According to a first approach developed by V.V. Ageev, the dose of phosphate and potash fertilizers were calculated as follows:

$$D = \frac{C - C \times K_n}{K_u} \times 100,$$

D – dose P_2O_5 and K_2O, kg / ha;
C – carryover P_2O_5 and K_2O with the planned yield of grain, kg / ha;
K_n– factor of using phosphorus and potassium from the soil by the carryover of the planned yield of grain;
K_u – the utilization rate of phosphorus and potassium from fertilizers.

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The doses of nitrogen fertilizers were calculated according to the updated formula:

$$B = \frac{C_{(N)} - C_{(P2O5)} \times K_{n(P2O5)\times K}}{K_u} \times 100$$

K – ratio of the carryover by N with the planned yield of grain to the carryover of P_2O_5 to the planned harvest of grain;
K_u – the utilization of nitrogen from fertilizers.

According to the second method, developed by scientists of Stavropol Agricultural Research Institute and and agrochemical company "Stavropolskiy", fertilizer doses were calculated according to the formula:

$$D = Y \times C \times K_k$$

Y – planned grain yield, t / ha;
C – carryover N, P_2O_5 и K_2O with 1 quintal of the planned yield of grain, kg;
K_k– factor compensation carryover of componentry nutrition removal due to fertilizers.

RESULTS AND DISCUSSION

According to long-term data in place of the tests indicated elevated temperature conditions in summer and autumn periods. In winter, the temperature and snow cover is unstable. Spring prolonged cold, the temperature regime is unstable. Average rainfall per year - 623 mm. The average annual air temperature - 9,2 °C.

The results of the study of the biological effectiveness of different doses of fertilizer, and the ratio of their nitrogen and potassium in relation to root rot of winter wheat are shown in Figure.

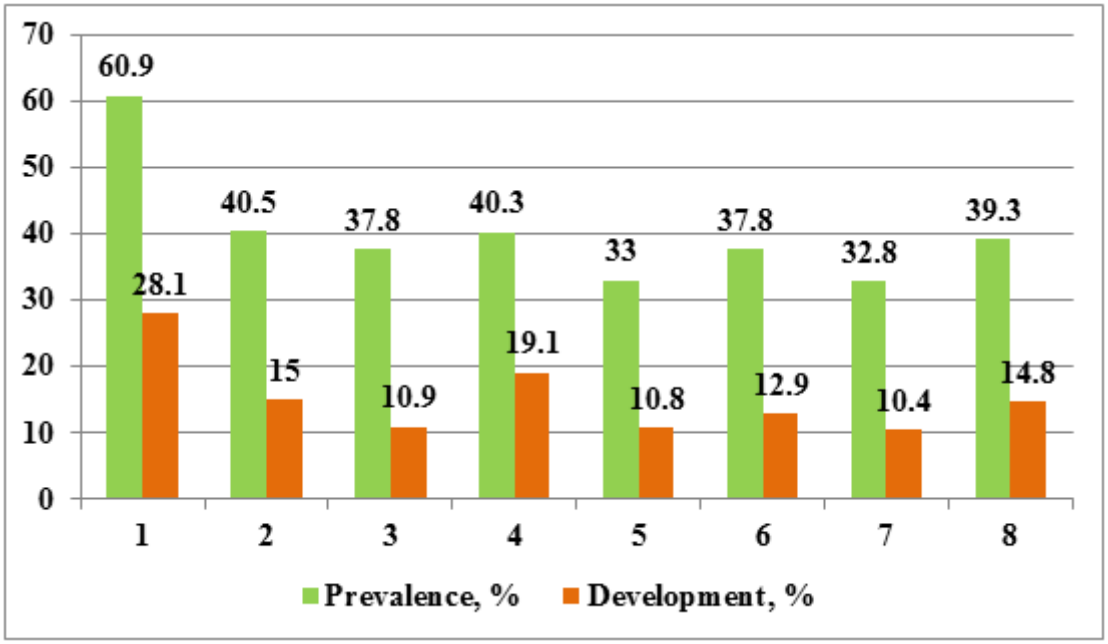

Figure 1: Dependence attack root rot plants of winter wheat depend on a dose mineral nutrition (average for 2010-2014.): 1 - control (without fertilizer); 2 – $N_{60}P_{60}K_{30}$; 3 – $N_{60}P_{34}K_{34}$; 4 – $N_{68}P_{44}K_{24}$; 5 – $N_{105}P_{60}K_{60}$; 6 – $N_{90}P_{67}K_{40}$; 7– $N_{126}P_{80}K_{72}$; 8 – $N_{110}P_{82}K_{51}$

Studies have shown that lowering the dose of potassium below K_{30} does not justify itself with the phytosanitary point of view, since it leads to an increase in the development of root rot to the level of control without fertilizer. The recommended dose of fertilizers $N_{60}P_{60}K_{30}$ to reduce this indicator by 1.9 times.

Analysis of the prevalence of winter wheat root rot of plants, depending on the dose of fertilizers while increasing projected yields to 5-6 tons / ha leads to a conclusion about phytosanitary proportions between nutrients. It was found the most optimal from a phytosanitary point of view is the ratio of nitrogen and potassium of 1.7: 1, which allows you to keep the development of the disease within the economic threshold ETH = 10-15%.

Upward displacement of the ratio to 2.2-2.8: 1 leads to the development of the disease within the upper level ETH and above.

CONCLUSION

Thus, the study results suggest that the regulation of the optimal level and balanced mineral nutrition of plants is one of recovery factors phytosanitary condition of winter wheat.

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