Influence of biological drugs on phytosanitary condition of seeds of spring barley

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Abstract. An important role is played to improve the stability of grain production for the modern protection of plants in the Republic of Mari El. A large number of areas allocated for grain crops are characterized as not favorable phytosanitary conditions, where the shortage of crops can reach 25 percent or more in the republic’s farms. The phytosanitary condition of cereal lands is permissible on the basis of the development of protective measures, optimization and intensification of factors that affect the size of the crop, its further increase and are the determining stage of the phytosanitary monitoring and plant protection system. These results determine the degree of development and spread of pests throughout the growing season. It is difficult for phytosanitary conditions to use non-quality seeds on farms, to reduce the use of plant protection products in processing seeds and crops, to violate the sowing season and to permanently change the population and species diversity, as well as favorable agro-climatic conditions. An essential task to overcome these negative trends is to increase the phytosanitary condition of agricultural lands based on the effective use of plant protection products and systems. The degree of phytosanitary state of crops is determined by the fertility of the soil, that is, the soil must be clean from phytopathogenic microorganisms, pests, weeds and toxic substances that can be released during the decomposition of organic sub-stances and rhizosphere microorganisms of the plant. Therefore, the treatment of seeds before planting with biofungicides positively affects the seed quality of seeds, reducing the development of phytopathogenic microorganisms, especially the pathogenic potential of root rot agents.

1. Introduction
The main task of agriculture in the Russian Federation is to increase the productivity of quality grain. The main role for solving this problem, increasing the yield and increasing the production of grain crops in the country, is assigned to the use of intensive production technologies in the areas of plant growing, agriculture and plant protection. Therefore, the formation of the future crop of crops begins at the stage of seed preparation, where an essential task is to increase the phytosanitary condition of agricultural land based on the effective use of monitoring, plant protection products and systems. The creation of elements for the productivity of sowing is not a fast process, but a phased one, where its basic elements, which are not formed at the very first stages of development, cannot be recovered by subsequent agrotechnical methods at later stages. Some researchers [1, 2] testify that it is more expedient to conduct phytosanitary examination and seed treatment before sowing. This allows us to achieve the greatest germination of seeds, their growth energy, tillering, root formation, and also the
formation of a significant amount of plant resistance to the phytopathogenic complex of microorganisms and unfavorable agroclimatic conditions.

For 2015-2017, the phytosanitary situation and the ongoing work on plant protection in the Republic of Mari El was controversial and showed that in 2015 on spring barley root shoots in the area of about 2.257 thousand hectares were recorded in the phase of shoots-tiller ing, with a lesion of 8.3 - 19.3% of plants and the intensity of the lesion is 2.6-7.8%. Before harvesting of spring barley, the phytosanitary state of seeds with root rot on the whole area of crops was: prevalence 35.9-84.6%, and development 14.8-43.2%. In 2016, the root rot disease was recorded on an area of 8,694 thousand hectares with a lesion of 12.8-87.0% and an intensity of 2.5-22.0% of plants. The growing result of 2017 on the contamination of plants of spring cereal crops with root rot was a disease of 6.947 thousand hectares of plants with a spread of 8.0-91.0% and development of 2.0-22.6%, promoted by a high reserve of soil and seminal infection, as well as meteorological conditions of the second half of the growing season [3, 4].

Climatic conditions in recent years in the Russian Federation have revealed that the development and spread of phytopathogenic microorganisms, especially from the genera Fusarium spp. and Bipolaris sorokiniana is growing all over the world. This is facilitated not only by the climate, but also by a decrease in the quality of the grain. In this regard, in non-quality and infected seeds, the energy of germination and the germination of seeds are substantially reduced.

The use of biofungicides for the treatment of seeds is the least costly and ecological method in agricultural technology, which is aimed at increasing the productivity of agricultural crops, since chemical dressers can act depressingly on the development of seedlings. In connection with this, at the present moment the most growing line is the application of pre-sowing treatment of seeds of grain crops with biological preparations, which is one of the elements of the technology of pre-sowing processing of seeds of agricultural crops. Especially it becomes very important in the late stages of sowing grain crops, when increasing the seeding rate is inappropriate, and to conduct treatment with biofungicides is the most important technique and scientifically justified. Where the feature of biological preparations is the impact on the surface of seeds by a useful microflora. Microorganisms, which are the basis for biological preparations, closely interact with plants and are able to perform the functions of stimulating their growth and development, suppress the formation of phytopathogenic fungi, and also have a positive effect on beneficial microorganisms, increasing resistance to stress and yield [5-7].

2. Experimental part

The research was conducted in 2016-2017. laboratory methods at the Department of General Agriculture, Agrochemistry, Plant Production and Plant Protection of the Mari State University. Objects of research: seeds of spring barley of variety Vladimir.

The laboratory experience was laid by a roll method and in petri dishes, in 3-fold replicates, before sowing and after harvesting, according to the scheme: 1. Control, without seed treatment; 2. Seed treatment with the drug Extrasol (200 ml/ton); 3. Seed treatment with Flavobacterin (150 ml/ton).

Extrasol is a microbiological preparation that possesses growth-stimulating and protective action. It successfully combines the best qualities of biological and chemical preparations. The basis of the preparation is a strain of rhizosphere bacteria Bacillus subtilis Ch-13, they were isolated from the rhizosphere of healthy plants. Extrasol struggles with harmful microorganisms, increasing the immunity of plants and protecting them from stress.

Flavobacterin is a broad-spectrum biofungicide. The preparation includes bacteria belonging to the genus Flavobacterium. These bacteria produce highly active antibiotic "flavocine" with a wide spectrum of action against phytopathogenic microorganisms and to remove the stress factor from plants.

Observations, records and analyzes were conducted in accordance with the research program. Laboratory analyzes on the appropriate methods for the zone, diagnosis and recording of the damage
of spring barley by diseases according to the method. For the isolation of pathogens, the nutrient medium of Czapek-Dox was used.

3. Results and considerations
The essential purpose of determining the sowing qualities of spring barley seeds is to identify their value as a seed. Under the energy of germination, which is characterized as the amicability of germination of seeds, one understands the amount of normally germinated seeds for a certain period, established for each culture, expressed as a percentage. The energy of germination and the germination of seeds show the most important index of their sowing qualities, determining their suitability for sowing and the rate of sowing. Seeds with a high energy of germination and, therefore, with good germination with good agricultural technology always give friendly and full-fledged shoots. Seeds, which do not conform to the requirements of the standard for germination, are not allowed to be used for sowing, since seeds with low germination yield low yields during sowing. Therefore, such seeds are useless. The energy of germination of seeds affects the sowing qualities of seeds of agricultural crops to the same extent, because a large number of factors affect the germination energy, such as traumatization of seeds, heavy metal salts, biological preparations, and so on. The most important factor is biological preparations that act on seeds with their strains of bacteria, inhibit the development of phytopathogenic microorganisms, stimulate growth and development in plants. Biological preparations not only support the formation and growth of plants, but also increase their vitality, enhancing the immunity of plants [8, 9].

In connection with this, our research goal was to identify the best biologics and their effects on the sowing characteristics of spring barley seeds. The research tasks included studying the influence of biological products on germination energy and seed germination (table 1).

| Table 1. Determination of germination and germination energy, %. |
|----------------------------------|-----------------|-----------------|
| Index                            | Energy of germination (3 days) | Germination (7 days) |
| Normally germinated              | 18.6            | 21.3            |
| Not germinated                   | 6.0             | 0               |
| Abnormally sprouted              | 12.0            | 5.3             |
| Swollen                          | 4.6             | 31.0            |
| Rotten                           | 21.6            | 45.3            |

Analysis of the results of the studies for 2 years showed, table 1, that the energy of germination of barley seeds of the variety Vladimir on the 3rd day revealed 21.6% - rotten seeds, swollen, not germinated and abnormally sprouted, respectively - 4.6, 6 and 12%. The seeds that sprouted normally turned out to be 18.6%. After 7 days, the germination of the seeds showed that only normally germinated seeds accounted for 21.3% of the seeds. The remaining seeds fell into decayed, swollen or not germinated seeds. At the same time rotten seeds turned out to be 45.3%.

The study of the influence of biological preparations on the sowing characteristics of spring barley seeds of the variety Vladimir showed (table 2) that the energy of seed germination in variants with processing of drugs Extrasol and Flavobacterin before sowing differs from the sowing qualities of the seeds after harvesting.

| Table 2. Effect of biological preparations on the sowing quality of spring barley, %. |
|----------------------------------|-----------------|-----------------|-----------------|-----------------|
| Sowing quality of seeds          | Before sowing   | After Harvesting |
| Energy of germination            | Control | Extrasol | Flavobacterin | Control | Extrasol | Flavobacterin |
| Laboratory germination           | 18.6    | 21.0    | 22.5          | 16.0    | 25.5    | 35.0          |
|                                  | 21.3    | 25.0    | 29.5          | 17.5    | 29.5    | 36.0          |
Table 2 shows that before sowing on variants with biopreparations the germination energy and seed germination exceeded the control variant of the experiment by 2.4 and 3.9%, and laboratory germination by 3.7 and 8.2%. After harvesting, the improvement in the sowing qualities of barley seeds was also observed in variants with biopreparations, where, in comparison with the control variants (before and after harvesting), Flavobacterin treatment of the seeds had a significant effect on the germination energy and seed germination. Flavobacterin treatment of spring barley seeds increased the germination energy (by 16.4 ... 19%), and germination (by 14.7 ... 18.5%).

The positive effect of biopreparations contributed to the resistance of seeds to damage to pathogenic organisms. Laboratory studies to identify the development of pathogenic microorganisms have shown that pre-sowing treatment of spring barley seeds with biological preparations extrasol and flavobacterin well inhibits the causative agents of root rot. So phyto-examination of barley seeds, before sowing (Table 3) showed that barley seeds are affected by pathogenic organisms of various etiologies that survived during the winter.

All seed material carries a complex of pathogens (fusariosis, helminthosporiosis, mold blooming, etc.), which determines the possible detection of them in the soil and appearance on plants during vegetation under optimum pathogen development conditions.

**Table 3. Proportion of affected barley seeds with root rot before sowing.**

| Options    | Healthy seeds, pcs. | Seed contamination total, pcs. | including, % |
|------------|---------------------|--------------------------------|--------------|
|            |                     | Fusarium spp. | Bipolaris sorokiniana | other mushrooms |
| Control    | 8                   | 92             | 14.2            | 51.1               | 35.1          |
| Extrasol   | 12                  | 88             | 17.5            | 47.2               | 35.3          |
| Flavobacterin | 35                | 65             | 12.3            | 15.6               | 13.7          |

The share of affected barley seeds with root rot before sowing in all variants of the experiment showed that mainly fungi from the genera Fusarium spp. and Bipolaris sorokiniana. When treated with biological preparations, the contamination of the seeds was different. So the greatest damage of seeds by pathogens was revealed on the control variant - 92 pieces. In extrasol and flavobacterin variants, the incidence decreased by 4 and 27, respectively. In this case, the seeds infected with Bipolaris sorokiniana mushrooms, on the control option, were 51.1%, which is 3.9% less than the extrasol version, and 35.5% more than the flavobacterin variant. A different situation occurs in infected seeds with fungi of the genus Fusarium spp., where the highest infection was observed on the extrasol version - 17.5%, which is 3.3 and 5.2% higher, respectively, than in control variants and flavobacterin. The lowest percentage of infection of seeds with other fungi was found on the variant flavobacterin - 13.7%, compared to the control, this indicator decreased by 13.0%, and with the extrasolar variant by 9.6%.

After harvesting, the phytoexamination of barley seeds showed that the species composition of pathogens of the genus Fusarium spp., Bipolaris sorokiniana and other fungi did not change. The least number of uninfected seeds with pathogenic fungi was found on the variant flavobacterin - 73 pieces, while in the control variant the seeds were completely affected, and on the extrasolar version, 70% (table 4).

**Table 4. Phyto-examination of spring barley seeds after harvesting.**

| Options    | Healthy seeds, pcs. | Seed contamination total, pcs. | including, % |
|------------|---------------------|--------------------------------|--------------|
|            |                     | Fusarium spp. | Bipolaris sorokiniana | other mushrooms |
| Control    | 0                   | 100             | 16.3            | 56.8               | 36.9          |
Seed contamination by pathogenic fungi of the genus Fusarium spp., Bipolaris sorokiniana and others was the largest control option, and the least flavobacterin variant. When infected with fungi of the genus Fusarium spp. The difference between the optimal variant of flavobacterin and control was 8%, and between the extrasolar variant - 2.8%. A similar situation was observed in seeds affected by pathogens from the genus Bipolaris sorokiniana and other fungi.

4. Conclusion
Thus, the phytosanitary state of the spring barley seeds of the variety Vladimir showed that the treatment of seeds before sowing with biologics Extrasol and Flavobacterin positively affects the seed quality of the seeds. Treatment of spring barley seeds with the biological preparation Flavobacterin increased germination energy by 16.4 ... 19% and laboratory germination by 14.7 ... 18.5%.

The positive effect of biological products also contributed to the resistance of seeds to the defeat of phytopathogenic microorganisms, reducing the development of root rot agents by 30 ... 70%.

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