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Influence Of Associations Of Soil Bacteria On The Structure And Productivity Of Spring Wheat

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Abstract
The soil and climatic conditions of the Zhambyl region was verified the growth promoting activity of spring wheat plant associations of soil bacteria (№27, 44, 62). The experiments revealed that the association selected enhance germination, productivity and structure of the spring wheat crop. When preplant treatment of seeds field germination associations increased 4, 3-8, 3 % yield increase of 10,2% - 22,9 %, as well as improved seed quality indicators compared to the control.
Key words: spring wheat, the association of microorganisms, biological product, field germination, yield, growth stimulation.

I. Introduction

Spring wheat in Kazakhstan is one of the main cultivated crops, as is necessary for the production of food for the population of the country [1]. In recent years there has been reducing its yield [2], which is associated with the violation of agricultural practices in the cultivation of crops, unfavorable climatic conditions [3], as well as a decrease in the resistance of varieties to pathogens [4]. To combat the latter, currently used agricultural chemicals (pesticides and fertilizers). This leads to a number of negative consequences: pollution of soil and water, the formation of resistant strains of plant pathogens and reduce the number of beneficial microorganisms, as well as reduce quality of the crop due to the accumulation of toxic substances in the final product. One solution to this problem is the development and use of biological products based on highly active microbial strains - antagonists of pathogens of different nature. Methods for their use are varied. These treated seeds before sowing and germination surface to enhance the stability of crops [5]. Biological products are harmless to humans and the environment and their cost is much lower, which is very important in the current economic conditions [6-9].

Our work was aimed at finding associations among soil microorganisms, growth stimulants active seed spring wheat, as well as a comparative analysis of the effectiveness of their preplant treatment.

II. Materials and Methods

To isolate microorganisms soil samples were taken outside the areas of intensive land use. Microorganisms were isolated on media MPA, MRS with chalk and on the medium 79 to nitrogen-fixing bacteria. From isolated microorganisms composed of 285 associations. The ratio of the association of cultures was 1: 1.

The laboratory experiment to stimulate the growth of plant associations composed of microorganisms. The experimental data showed that the three unions (№№ 27, 44, 62) exhibit growth stimulating activity as the roots and stems of plants by 70-75 %. Seed germination increased by 5-10 %. With these associations set field experiments in soil and climatic conditions of Zhambyl region on the territory of Zhambyl branch of the Kazakh Research Institute of Agriculture and crop production. For the study used the seeds of spring wheat varieties "Kazakhstan", provided the same institution. Plant seeds before sowing soaked for 1 hour in the cell suspension (concentration of 1×10^8 cells/ml) and seeded into soil in small plots based on 20 kg per association, and control (untreated seeds). During the growing season for crops of spring wheat were carried out phenological observations of plant growth and development in ontogenesis.

Environment

Environment for saprophytic microorganisms Nutrient agar contains:
Agar – 15,00 g; peptone – 5,00 g; sodium chloride – 5,00 g; beef extract – 1,50 g; yeast extract – 1,50 g; distilled water – 1 ltr.
Environment for lactobacilli MRS agar contains:
Dextrose – 20,00g; agar – 15,00 g; proteose peptone №3 g; beef extract – 10,00 g; yeast extract – 5,00 g; sodium acetate – 5,00 g; ammonium citrate – 2,00 g; potassium phosphate dibasic – 2,00 g; sorbitan monooleate complex – 1,00 g; magnesium sulphate –

0,10 g; manganese sulphate – 0,05 g; distilled water – 1 ltr.
Environment for fixing microorganisms №79 contains:
NaCl – 0,10 g; K2HPO4 – 0,50 g; MgSO4 – 0,20 g; CaCO3 – 0,01 g; mannite – 10,00 g; yeast extract – 1,00 g; agar – 20,00 g; distilled water – 1 ltr.

III. Results and Discussion

During the growing season for crops of spring wheat were carried out phenological observations of plant growth and development in ontogenesis.

The phenological observations of spring wheat varieties "Kazakhstan" show some of the differences between the duration of the period from planting to emergence. Sowing held April 5, 2014 Shoots appeared on 9 and 14 days after planting, depending on the application of biological products. Thus, in embodiments, with associations №№27, 44 and 62 the primary spring wheat seedlings were observed respectively at 11, 9 and 10 days after planting, whereas in the control variant shoots appeared on day 13. In the future, the transition phenophases is bucking the trend, that is, the use of drugs to an increase in the duration of phases. Thus, the phase of tillering advancing to the 3 decade of April and lasted 20-28 days, depending on the use of drugs. The increase in the period of tillering helped to improve productive stems, which eventually increased the yield of spring wheat. Thus, in the embodiment with associations №№27, 44 and 62 respectively tillering lasted 27, 28 and 25 days, whereas in the control variant tillering ceased on the 20th day. Phase booting marked the end of III decade of May, and the phase of earing - II decade of June, flowering - from II decade of June. Full maturity is marked in the first decade of July. In embodiments using preparations vegetation period increased to 5-7 days compared to the control one. Thus, increasing the growing season has contributed more fully realize the photosynthetic capacity and the accumulation of biomass.

The results of counting after germination ascertained that the field germination depended largely on the use of drugs. Thus, when seeding rate of 3,5 million. Germinating grains per 1 ha in embodiments №№ 27, 44 and 62, with the processing of seed germination was respectively 84,3; 81,4 and 85,4 % , while in the embodiment, the control – 77,1 %.

Most germination observed in embodiments associations number 27 and number 62, where the field germination was greater by 8,3 % and 7,2 % compared to the control one.

The use of drugs contributed to the decline lunge plants for harvest. Thus, the plant population for harvest ranged from 260 to 275,9 plants per $1m^2$, attack plants ranged from 6,8% to 8,8 %. The largest attack occurred in the control variant and 10,4% (Table 1) .

Table 1 Germination and plant density of spring wheat harvesting

Treatments	Seeding rate, mln . pcs. ha	Germination, %	Completeness of seedlings after planting, pcs / m^2	Lunge for vegetation, %	The number of surviving the spring, pcs / m^2
Control	3,5	77,14	270	10,4	242
27	3,5	84,3	295	6,8	275
44	3,5	81,4	285	8,8	260
62	3,5	85,4	299	7,7	275,9

Seed pre-treatment bacterial associations also contributed to seed yield of spring wheat. The results of the surveys found that their use helped to increase wheat yields, reasonable increase germination, reduced plant lunge for harvesting and other positive factors forming the harvest. The relatively good harvest obtained with an embodiment of Association number 27 – 22,5 c/ha, which is 4,2 t/ha higher than the reference version with a yield of 18,3 c/ha (Table 2).

Table 2 Yields of spring wheat seed

Treatments	Productivity, quintals per hectare	Increase	
		quintals per hectare	%
Control	18,3	-	-
27	22,5	4,2	22,9
44	20,2	1,9	10,2
62	21,4	3,1	16,9

The same pattern is observed in other embodiments using drugs, yield increase ranged from 1,9 to 4,2 t/ha, respectively, from 10,2% to 22,9 % more than the control options.

Results of the analysis of seeds of spring wheat showed that the quality of the grain (801%) improves Association №44. Vitreous grain texture characterizes its endosperm. Vitreous indicates the nature of the protein or starchy grains. Wheat with a predominance of vitreous kernels usually has a relatively high content of protein and gluten good baking qualities. The degree of glassiness was 90% after treatment with the association №62, which exceeds the control value of 8%. As the gluten content (44,1%) is the best association №27 (Table 3).

Table 3 - Results of the analysis of seeds of spring wheat cultivar "Kazakhstan"

Treatments	Nature, %	Vitrescence, %	Gluten,%	Indicators alveograph		
				P	P/L	W
Control	759	82	40,4	75	1,19	416
27	801	89	44,1	82	1,51	450
44	802	88	42,8	85	1,33	445
62	798	90	43,5	79	1,45	440

The analysis of the data over a larger number of indicators of quality of grain is the best association №44. Based on this analysis it can be concluded that the use of microorganisms associations improves plant growth, as in the initial stage of development, and in the subsequent growing season, affecting the germination, formation, weight of plants, and chemical composition of the yield. The best associations of microorganisms that affect the growth and protection of spring wheat is №27. The vast majority of micro-organisms belonging to the associations belong to the genera: *Bacillus, Lactobacillus, Azomonas, Azotobacter, Acetobacter, Zymomonas, Flavobacterium.*

Using the obtained associations of soil microorganisms in the creation of complex multi-component biological preparation comprising a variety of physiological groups of microorganisms that promote plant growth, will improve the survival rate of a biological product components in the soil and increase the yield of crops, as well as improvement of soil microflora and agricultural products.

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