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The Application of New Generation Growth Regulators to Increase the Grain Productivity of Winter Wheat.

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ABSTRACT

Winter wheat is a valuable food crop of the forest-steppe zone of the Volga region. In spite of the fact that soil and climatic conditions to cultivate this crop in the region are rather favorable, the yielding capacity and grain quality still remain low. Therefore now the search for methods of increasing the yielding capacity and grain quality of winter wheat is being conducted. Now new generation growth regulators including melafen and pirafen have been created. However their action on the formation of yielding capacity and grain quality of winter wheat in the conditions of the forest-steppe of the Volga region practically is not studied. In the course of the studies it is proved that the pre-sowing treatment of seeds with new generation growth regulators increases protein content in grain of winter wheat, increases the content of irreplaceable amino acids, an amino-acid score, gluten and nature of grain of winter wheat, as a result of it grain of high quality is achieved.

Keywords: winter wheat, growth regulators, yielding capacity, an amino-acid score

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INTRODUCTION

In works of many researchers [1,3-5,7] it is noted about the increase of yielding capacity as a result of the pre-sowing treatment of seeds by various growth regulators.

The yielding capacity level – is an integrated indicator, including the realization of a productivity potential with a condition of factors of the environment and the modern treatment methods put in a plant genome that is used as a means for full manifestation of metabolic processes of the cultivated crop.

MATERIALS AND METHODS

The purpose of researches was to study the influence of the pre-sowing treatment of seeds with growth regulators on the formation of yielding capacity and grain quality of winter wheat in the forest-steppe of the Volga region.

Field experiments were conducted in 2005-2008 on the experimental field of the Ulyanovsk State Agricultural Academy.

The frequency of experiments is quadruple with the registered area of plots of 15 sq.m. The placement of plots is randomized. The agrotechnology on all the options of the experiment which was applied is traditional for this climatic zone. The scheme of the field experiment included 6 options of the pre-sowing treatment of seeds:

1. Control plot; 2. Gibberellin; 3. Melafen of $1 \bullet 10^{-7}$%; 4. Melafen of $1 \bullet 10^{-8}$%; 5. Pirafen of $1 \bullet 10^{-7}$%; 6. Pirafen of $1 \bullet 10^{-8}$%

The seed treatment was carried out before sowing at the rate of 2 liters of solution on 1 centner of seeds. On the control plot seeds were treated with water, on experimental plots with working solutions of gibberellin, melafen and pirafen (the concentrations were determined at the Kazan institute of organic and physical chemistry named after A.E. Arbuzov and at the Ulyanovsk State Agricultural Academy).

Melafen is referred to heterocyclic and organophosphorous chemical compounds, namely to melamine salt BIS (oxymethyl) of phosphinic acid. The preparation was synthesized at the Institute of organic and physical chemistry named after A.E. Arbuzov (Kazan). The molecular mass of melafen – 252,18. Pirafen is an analog of melafen. The molecular mass of pirafen – 251,18.

The target of research was winter wheat of the variety Volzhskaya K, the variety was bred in 2004 at the department of selection, seed breeding and genetics of the Ulyanovsk State Agricultural Academy by the method of individual selection from the synthetic population that was obtained from the crossing of breeding varieties of winter wheat VSGI with Kinelskaya 4.

Data of the study results were mathematically processed by means of variance and correlation and regression analyses [2,6].

RESULTS AND THEIR DISCUSSION

The data obtained during the years of studies show that the applied new generation growth regulators considerably intensify growth and physiological processes, provide the best mineral and air nutrition of plants during the individual development of winter wheat plants, as a result, the yielding capacity increases.

The results of our researches (table 1) show that on average for the years of researches the yielding capacity in experimental options increases by 0,27 – 0,38 t/hectare, with the yielding capacity on the control plot of 2,8 t/hectare. The greatest increase of 0,38 t/hectare was provided by the application of melafen in concentration of $1 \bullet 10^{-7}$%.

The yielding capacity elements in the course of ontogenesis of winter wheat are formed gradually.

The process of forming structural elements substantially depends on the used growth regulators.

Table 1: Influence of growth regulators on the winter wheat yielding capacity, t/ha

Option	Years of studies				Increase to control	
	2006	2007	2008	Mean	t/ha	%
control	1,96	2,90	3,55	2,80	-	100
gibberellin	2,26	3,27	3,67	3,07	0,27	+109,64
melafen 1•10^{-7}%	2,40	3,33	3,80	3,18	0,38	+113,57
melafen 1•10^{-8}%	2,09	3,25	3,77	3,04	0,27	+108,57
pirafen 1•10^{-7}%	2,30	3,40	3,67	3,12	0,32	+111,43
pirafen 1•10^{-8}%	2,28	3,30	3,78	3,12	0,32	+111,43
LSD $_{05}$	0,12	0,13	0,20	0,10		

Table 2: Influence of growth regulators on the components of the winter wheat yielding capacity structure

Years of studies	Options	Number on 1 м^2,		Number of grains in the ear	Weight, gr.	
		Plants before harvesting	Productive stems		Grain from one ear	Weight of 1000 grains
2006	control	254±3,59	422±6,18	24,8±0,86	0,96±0,05	38,6±1,48
	gibberellin	268±2,06	450±9,91	25,9±1,03	1,02±0,04	39,4±1,10
	melafen 1•10^{-7}%	299±1,71	483±4,99	26,3±1,08	1,08±0,07	40,9±1,67
	melafen 1•10^{-8}%	287±2,22	468±5,74	25,6±0,96	1,04±0,06	40,6±1,29
	pirafen 1•10^{-7}%	296±2,65	471±4,57	26,9±1,18	1,07±0,06	39,9±1,30
	pirafen 1•10^{-8}%	289±2,99	452±4,32	26,8±0,88	1,06±0,05	39,5±0,60
2007	control	279±2,58	444±4,27	23,1±0,87	0,92±0,03	39,8±0,86
	gibberellin	304±3,30	497±5,50	24,2±0,93	0,99±0,04	41,3±1,27
	melafen 1•10^{-7}%	319±3,30	519±4,04	24,9±0,58	1,04±0,05	41,6±1,33
	melafen 1•10^{-8}%	314±3,40	519±5,19	23,9±1,00	0,98±0,03	40,9±1,01
	pirafen 1•10^{-7}%	317±3,30	497±3,95	24,3±0,79	0,99±0,04	40,7±0,75
	pirafen 1•10^{-8}%	314±4,43	501±5,20	23,7±1,06	0,95±0,04	40,2±0,82
2008	control	288±3,56	453±5,38	23,8±1,14	0,95±0,03	40±0,64
	gibberellin	313±3,30	501±5,72	24,8±0,91	1,02±0,05	41,1±1,56
	melafen 1•10^{-7}%	327±3,30	533±6,18	25,4±1,27	1,06±0,05	41,7±1,51
	melafen 1•10^{-8}%	319±1,71	528±2,94	25,2±1,40	1,05±0,03	41,6±1,12
	pirafen 1•10^{-7}%	321±3,30	513±2,75	25,6±1,12	1,03±0,04	40,2±0,90
	pirafen 1•10^{-8}%	301±2,50	494±4,55	25,4±0,91	1,03±0,03	40,6±0,86
On average	control	274	523	23,9	0,94	39,5
	gibberellin	295	573	25,0	1,01	40,6
	melafen 1•10^{-7}%	315	608	25,5	1,06	41,4
	melafen 1•10^{-8}%	307	599	24,9	1,02	41,1
	pirafen 1•10^{-7}%	311	586	25,6	1,03	40,3
	pirafen 1•10^{-8}%	301	575	25,0	1,01	40,1

The structure elements have a great effect on the yielding capacity formation. Yielding capacity depends on a number of plants that are preserved for harvesting, productive stems, the number of grains in the ear and the weight of 1000 grains (table 2). The results of studies showed that after applying new generation growth regulators the number of plants for harvesting was more by 9,9-15% in comparison with the control group; the number of productive stems was more - by 9,6-16,4% and 2,2-5,9%, the number of grains in the ear - by 4,6-7,1%, and 6,7%, the grain weight from one ear – by 7,4-12,8 and 5%, the weight of 1000 grains – by 1,5- 4,8% and 2% respectively. The effect of gibberellin on the productiveness components of winter wheat was insignificant.

The positive correlation dependence was established between yielding capacity and elements of the yielding capacity structure.

In 2006 - $y=-0,956+0,039x_1 + 0,229x_2 + 0,00627x_4$, where y – grain yield of winter wheat, t/ha, x_1 – number of grains in the ear, pcs., x_2 – grain weight from one ear, gr., x_4 –number of productive stems, pcs./м^2. The highest dependence of yield was observed to be on the number of productive stems, where it amounts to – 37,5%, with total dependence on the studied factors - D=56,35%, r=0,75. In 2007 - $y=0,571 + 0,268x_2 + 0,00731x_4$ the yielding capacity is also maximally dependent on the number of productive stems – 60,1%, with total dependence - D=64,56%, r=0,80. In 2008 - $y=1,897+0,0118x_1 + 0,685x_2 + 0,00236x_4$ the dependence of factors was similar to that of the previous years, i.e. there was the biggest connection of yielding capacity with the number of productive stems – 13,87%, with total dependence - D=27,14%, r=0,52.

On average during the years of studies: $y=0,485+0,0139x_1 + 0,924x_2 + 0,00395x_3$, D=69,4%, r=0,8.

In the stage of tillering - $y=1,134+0,026x_1 + 0,00153x_2 + 0,0407x_3$ D=71%, r=0,8, in the stage of booting - $y=0,974+0,0607x_1 + 0,00168x_2$ D=72,6%, r=0,8, in the stage of coming into ear - $y=0,63+0,0277x_1 + 0,00103x_2$ D=70,2%, r=0,8, in the stage of milky ripeness - $y=0,441+0,0164x_1 + 0,0013x_2 + 0,0142x_3$ D=79,8%, r=0,8. The coefficient of regression r=0,8 shows the average dependence between the studied factors.

Thus, the pre-sowing seed treatment with melafen and pirafen is an important influencing factor on plants that leads to the yield increase and is an efficient agronomic practice in the winter wheat cultivation technology.

REFERENCES

[1] Antonova T.A. Yield formation, cold resistance and winter wheat grain quality while using melofen in conditions of the forest steppe of the Volga region / T.A. Antonova: synopsis of the thesis – Penza, 2004. – p. 19.
[2] Dospekhov B. A. The technique of a field experiment (with bases of statistical processing of study results) / B. A. Dospekhov. - 5th prod., additional and revised. - M.: Agropromizdat, 1985. – pp. 351.
[3] Kostin V. I. Influence of growth regulators on quality indicators of winter wheat Volga K / V. I. Kostin, V.A. Isaychev, E.V. Provalova//News of the Orenburg SAA. - Orenburg. - 2008. - No. 2 (18). – pp. 15-17.
[4] Kostin O. V. Optimization of production process and accumulation of protein in grain of winter wheat Volga K / O. V. Kostin, E.V. Provalova//the Bulletin of Saratov State Agrarian University named after N. I. Vavilov". – Saratov. - 2008. - No. 3. – pp. 28-31.
[5] Kostin V. I. Elements of mineral food and growth regulators in ontogenesis of crops / V. I. Kostin, V.A. Isaychev, O. V. Kostin - M.: Kolos, 2006. – pp. 290.
[6] Piskunov A.S. Methods of agrochemical studies/A. S. Piskunov. - M.: Kolos, 2004.- pp. 312.
[7] Semyonov A.Yu. Effect of the pre-sowing treatment with pectin and microcells on physiologic and biochemical processes and productivity of winter rye / A.Yu. Semyonov: synopsis of the thesis. - Kazan, 2002. – p. 20.