THE INFLUENCE OF PRE-SOVING OZONIZATION OF SOFT SPRING WHEAT ON THE YIELDNESS AND IT'S STRUCTURE IN THE FOREST AND STEPPE ZONE OF KUZNETSK BASIN

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Abstract: *In the article there presented the results of the studies on the effect of pre-sowing seed ozonization to the grain quality of spring soft wheat by varieties of Mariinka and Iren' of middle-early group of maturity and its structure. The researches were conducted in the conditions of steppe zone of the Kemerovo region in 2009 - 2011 years.*

Key words: *spring wheat, presowing ozonization, yield and its structure, dose of ozone, time of presowing ozonization*

INTRODUCTION

Wheat is one of the principal vital crops in the world. Increase yield and quality of wheat is one of the main problems of agriculture (KUCHEROV, 2007). Important role in improving the quality and productivity of cultivated wheat seed is pre-sowing treatment. It allows to stimulate physiological and biochemical processes in the seeds, holds protection against infections and pests, increase vigor, as well as germination, that's lead to increased productivity (PUSHKAREV , 2009).

Currently, in the scientific and technological development there are change of the technologies and techniques for getting a high-quality grain. It is conducting a search for new and more effective ways to ensure the quality of grain and increase its productivity. In this connection it becomes more common the ozone technology.

Ozone air is widely used in agriculture. Being a strong oxidizing agent, ozone enters into chemical and biochemical reactions with the material of the grain, and has a disinfecting effect on it (GORSKY, 2004). Ozone (O_3) - allotropic modification of oxygen, disinfectant and deodorizing properties of it were set in the late XIX century. Ozone treatment is carried out to improve the yield, pest control and pathogenic organisms. The aim of the research was to determine the impact of pre-sowing ozonization of spring wheat seeds on yield and its structure.

MATERIAL AND METHODS

The studies were performed in 2009 - 2011 years in the steppe zone of the Kemerovo region (south-east of Western Siberia). Soils are gray forest ashed, heavy-loamy by granulometric composition.

The years of trial establishment were different by climatic conditions. Hydrothermal regime of 2009 was characterized as moderately warm and well moisturized, with a uniform distribution of heat and moisture for the growing season. In 2010, there was a warm dry weather in May - June, cool and humid in July, 2011 was warm and dry throughout the time the growing season. Hydrothermic coefficient (SCC), (SELYANINOV, 1933) of the growing season (May - August) was in 2009 - 1.1, 2010 - 1.3, 2011 - 0.85, with the optimal value for the wheat plants 1.3 - 1.6.

It was studied the effect of pre-sowing ozonization of spring soft wheat seeds by varieties Mariinsky of mid ripening and Iren of middle-early maturity groups on yield and its structure. Seed treatment was carried out on ozonator "Orion-SI." On the background of the control (without ozonation) seeds were treated with two doses of ozone by 85 and 170 mg/m ^{3} at two time modes by 15 and 45 minutes: the first option - 85 mg/m ^{3} 15 minutes, the second option - 170 mg/m ^{3} 15 minutes , 3rd option - 85 mg/m ^{3} 45 minutes, the fourth option - 170 mg/m ^{3} 45 minutes.

Sowing was performed on May 17, seven days after the ozonization. For mathematical processing of primary data it was used dispersive and correlation analyzes (Dospehov, 1985), made on a personal computer using the software package «Snedecor».

RESULTS AND DISCUSSIONS

Judging from the values of the coefficients of variation, pre-sowing ozonation of seeds had a significant impact on the yield of spring wheat. Varying the parameters of yields between variants of experiment by dates at variety Mariinka was 18 - 21% , at Iren 13 - 20% (Table 1). Little difference between the coefficients of variation by dates of research may indicate a weak dependence of the influence of pre-sowing seed ozonation on the yield from hydrothermal conditions.

For both varieties variation between variants of experiment was significant and was in 2009 - 23%, in 2010 - 29%, in 2011 - 25%, and the average over three years - 60%. Thus, the high yield variability on grades in total for three years may indicate a strong influence on it by hydrothermal conditions of years of research.

Table 1

Variability of spring soft wheat yield (t/ha)
depending on pre-sowing ozonation (varieties Mariinsky, Iren) 2009 - 2011.

Year	Variety	Control	15 minutes		45 minutes		V, %
			85	170	85	170	
2009	1*	3,09	3,21	3,53	3,34	3,77	18
	2**	2,89	2,92	3,20	3,01	3,32	13
	V, %	6	9	9	10	12	23
2010	1	3,08	3,41	3,72	3,35	3,92	21
	2	2,80	2,97	3,38	3,14	3,52	20
	V, %	9	13	9	6	10	29
2011	1	1,64	1,71	1,92	1,85	2,08	21
	2	1,57	1,64	1,88	1,75	1,93	19
	V, %	4	4	2	5	7	25
Average for three years	1	2,60	2,78	3,06	2,85	3,26	20
	2	2,42	2,51	2,82	2,63	2,92	17
	V, %	49	52	49	48	51	60

Сорта 1* – Mariinka, 2** – Iren

Higher grain yields were obtained in 2009 and 2010 compared with 2011. So in 2009 and 2010 Mariinka variety yield was ranged respectively from 3.09 and 3.08 t/ha (control) to 3.77 and 3.92 t/ha (option № 4), Iren variety of 2.89 and 2.80 t/ha (control) to 3.32 and 3.52 t/ha (option № 4), in 2011 - 1.64 and 1.57 t/ha (control) and 2.08 and 1.93 t/ha (option № 4).

Large yield by both varieties was formed by seeds treatment with ozone 170 mg / m ³ within 45 minutes. Moreover, the yield in all variants of the experiment in both varieties within each year apart, with some advantages Mariinka grade, was higher compared with the control.

The differences in yield between the studied varieties in each year of research on the individual variations of the experiment was less significant compared to the effect of ozonation on the variants of the experiment. However, in general for three years there was a significant difference (V = 48 - 52%).

On the basis of correlation analysis it is shown that both the ozone dose and the treatment of seeds before sowing them are poorly influenced the yield value (r = 0,26 and 0.18, respectively) (Table 2). As suggested above, the level of formed productivity is determined primarily by hydrothermal conditions of years of research (r = 0,86).

Table 2

Correlation coefficients between yield of spring wheat, the elements of its structure and experiment factors (Varieties Mariinka, Iren), 2009 – 2011

Index	Factor		
	Time of ozon treantment, min.	Ozon doze, мг/м^3	Hydrothermic coefficient May-August
Mass of 1 grain, g	0,08	0,01	- 0,40
Mass of 1000 grains, g	0,17	0,16	- 0,34
Length of the head, mm	0,35	0,18	- 0,64
Amount of spikelets, pcs	0,34	0,16	- 0,52
Amount of grains in head, pcs.	0,39	0,19	- 0,31
Productive tilling capacity	0,35	0,61	0,37
Yield, t/ha	0,18	0,26	0,86

After a detailed analysis of the structure of productivity, it is clear that the weather conditions are associated with an average degree of spike length, number of spikelets and productive tillering (r = 0,64, 0,52 and 0,37 respectively) and more weakly with other elements of the structure - a mass of 1 grain, mass of 1000 grains and the number of grains in head (r = 0,40, 0,34 and 0.31 respectively).

Ozone dose had a significant impact only on the productive tillering of wheat (r = 0,61). The duration of pre-sowing treatment of seeds was formed such indicators of yield structure as the number of grains per head and number of spikelets , its length and productive tillering (r = 0,39 and 0.34, 0.35 and 0.35 respectively).

Estimation of the proportion of changing of the yield of spring wheat on factors - ozone dose, time of its impact on seed, quality features and hydrothermal coefficient (SCC) of the growing season, held on the basis of multivariate analysis of variance (coefficient of determination d_{yx}), showed that the studied factors can be positioned in descending order of contribution to the yield variability in the following order: SCC during the vegetation period, ozone dose, the treatment time and grade (respectively, d_{yx} = 86,7; 4,9; 1,7 and 1,6%) (Table 3).

Percentage of influence of ozone dose was more significant on the productivity of tillering (d_{yx} = 39,8%), time of treatment of seed with ozone manifested weaker, but on a larger

number of indicators of structure of productivity - the number of grains per head, productive tillering, length of the head (respectively, d_{yx} = 13.3, 13.2, 11.0 and 9.6%). Varietal differences in response to the studied factors almost did not appear.

Table 3

Proportion of influence of factors on the yield of spring wheat and its structure (%) (grade Mariinka, Iren), 2009 – 2011

Index	Factors			
	Ozone dose, мг/м3	Time of ozone treatment, min	Variety	Hydrothermic coefficient May-August
Mass of 1 grain, g	2,1	1,0	1,1	42,9
Mass of 1000 grains, g	2,3	1,6	1,1	60,4
Length of the head, mm	1,5	11,0	1,1	39,6
Amount of spikelets, pcs	0,9	9,6	6,3	25,9
Amount of grains in head, pcs.	5,8	13,2	0,8	10,6
Productive tilling capacity	39,8	13,3	6,0	15,0
Yield, t/ha	4,9	1,7	1,6	86,7

The ratio of heat and moisture (SCC) was decisive in the formation of all elements of the structure, with a higher proportion of the impact of this factor on the weight of 1000 grains, weight of 1 grain, length of the head and number of spikelets in it (respectively d_{yx} = 60,4; 42,9; 39.6 and 25.9%).

CONCLUSIONS

On average for the three years pre-sowing ozonation had increased the yield on the options of experiment at variety Mariinka in 7 - 25%, at variety Iren in 4 - 21%. Differences in yield between the studied varieties in some years of research on the different cases of the experiment was less significant compared to the effect of ozonation by the variants of the experiment. Effect of pre-sowing seed ozonation of spring wheat on yields slightly changed under the influence of hydrothermic conditions observed during the study period.

Ozone dose significantly affected on the productive tillering of wheat (r = 0,61), the duration of pre-sowing treatment of seeds on the number of grains in head and spikelets, it's lengths and productive tillering (r = 0,39 and 0.34, 0.35 and 0, 35, respectively).

Studied factors in descending order by contribution to the yield variability are in the following order: SCC during the vegetation period, ozone dose, the treatment time and variety (respectively d_{yx} = 86,7; 4,9; 1,7 and 1,6%).

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