ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Combined Action of a Fungicide Seed Disinfectant And Growth Regulators To Increase Yielding Capacity Of Winter Wheat.

Elena Viktorovna Provalova*, Olga Nikolaevna Tsapovskaya, Sergey Evgenyevich Erofeyev, Nikolai Viktorovich Khvostov, Yury Vladimirovich Yermoshkin, and Sergey Vasilyevich Shaikin.

Federal state educational institution of higher education "Ulyanovsk State Agricultural Academy named after P. A. Stolypin". Address: 1, Novy Venets Boulevard, 432017, Ulyanovsk, Russia.

ABSTRACT

Our studies show that the influence of protective stimulating compounds in pre-sowing treatment of seeds increases the assimilatory surface of leaves, accumulation of dry weight, net productivity of photosynthesis and as a result increases yielding capacity of the studied crop. Compounds consisting of fungicides and growth regulators can combine anti-pathogenic, growth and immune-stimulating activities, and, besides, they have properties of inducing hardiness to a drought, high and low temperatures and other natural adverse factors of the environment.

Keywords: fungicide disinfectant of seeds, growth regulators, winter wheat, productivity.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

A promising approach to a complex crop protection against adverse effects of the biogenous and abiogenous character, in opinion of S. L. Tyuterev, the specialist in the field of plant hardiness, famous in Russia, is the creation of compounds based on fungicides, growth regulators, minerals, amino acids and other components called as protective stimulating substances. Interest in such sort of compounds is not accidental. It is well known that pesticides have a toxic effect on a plant organism which they are designed to protect, and at the same time the use of fungicides in practical crop production remains extremely urgent as causative agents of fungi diseases, especially in the period of epiphytoties, inflict a big loss to a grain yield. The combination of a fungicide and growth stimulator of plants in a complex compound which at the same time is characterized by a wide range of anti-stress activities can promote a decrease in the level of negative effects of a pesticide. This is supposed to give an additional increase of yield capacity of crops. Such biologically substantiated anti-stress compounds are likely to gain predominance in the future in adaptive plant breeding [3,4].

MATERIALS AND METHODS

The object of the study was winter wheat, the variety -Volga K. This variety was bred at the department of selection, seed breeding and genetics of the Ulyanovsk State Agricultural Academy.

The purpose of our work was to study the influence of growth regulators separately and in combination with fungicide Raxon on production processes and yielding capacity of winter wheat.

Field experiments were done on the experimental field of the Ulyanovsk State Agricultural Academy with quadruple replication on plots with the accounting area of 15 sq.m according to a technique of field experiments on fixed sites [2]. The soil of the experimental field – leached black soil of medium thickness, average loam with the following agrochemical characteristic: reaction of the medium – pH=6.5, humus content - 4,3%, content of mobile phosphorus and exchange potassium according to Chirikov -10,5 and 20 mg / 100gr of the soil respectively. The degree of base saturation was 96,4 – 97,9%, the amount of the absorbed base was 25,5 - 27,8 mg-equivalent/100g of the soil.

Design of the field experiment:

1. Control
2. Gibberellin
3. Melafen of $1 \bullet 10^{-7}$%
4. Melafen of $1 \bullet 10^{-8}$%
5. Pyrafen of $1 \bullet 10^{-7}$%
6. Pyrafen of $1 \bullet 10^{-8}$%
7. Raxon (fungicide disinfectant of seeds)
8. Gibberellin + Raxon
9. Melafen of $1 \bullet 10^{-7}$% + Raxon
10. Melafen of $1 \bullet 10^{-8}$% + Raxon
11. Pirafen of $1 \bullet 10^{-7}$% + Raxon
12. Pirafen of $1 \bullet 10^{-8}$% + Raxon

Treatment of seeds was carried out before sowing at a rate of 2 liters of solution for 1 centner of seeds. Raxon was used as a disinfectant of seeds, 60% of suspension concentrates.

The following observations, accounting and analyses were made in experiments:

- Biomass accumulation - by weighing plant samples according to the phases of plant development proposed by N. N. Tretyakov (1990).
- Determination of the assimilatory surface of leaves - according to N. N. Tretyakov (1990). Calculations were made on a formula: S = A×B× 0,78, where S – the leaf area (cm^2), A – the leaf width (cm), B – the leaf length (cm).

ISSN: 0975-8585

- Net Productivity of Photosynthesis (NPP) was calculated by a formula: $\mathrm{NPP} = \frac{B_2 - B_1}{(L_1 + L_2) \cdot n \cdot 0{,}5}$ where NPP – net productivity of photosynthesis, g/m2 • days; B_1, B_2 – the dry weight of a sample at the end and the beginning of the accounting period; L_1 and L_2 – the area of leaves at the beginning and the end of the accounting period, cm^2; n – number of days in the accounting period [5].
- Data of research results were subjected to mathematical processing by the analysis of variance, correlation and regression analyses [1].

RESULTS AND THEIR DISCUSSION

As we see from table 1 growth regulators in combination with a fungicide disinfectant of seeds cause a perceptible increase of the area of leaves due to significant suppression of diseases. The greatest effect is shown in variants - melafen 10^{-7}% + a seed disinfectant and pyrafen 10^{-7}% + a seed disinfectant where it is 1,09-1,2 times higher than in a variant with a seed disinfectant. The greatest square of leaves is observed in the phase of ear formation that it is associated with the growth of old and formation of young leaves. In the phase of milky ripeness the assimilatory surface of leaves decreases due to leaves' dying and outflow of assimilants from generative organs into reproductive ones.

Table 1 – Area of assimilatory leaf surface of winter wheat, cm^2 / 10 plants

Variant	Development stage			
	tillering	booting	ear formation	milky ripeness
Control	480,0	600,2	1185,6	937,7
Gibberellin	493,2	650,3	1256,3	1057,5
Melafen 10^{-7}%	586,9	663,9	1289,8	1115,4
Melafen 10^{-8}%	590,2	625,0	1184,4	1083,4
Pyrafen 10^{-7}%	572,3	700,2	1311,2	1135,3
Pyrafen 10^{-8}%	598,3	640,2	1199,4	1006,3
Raxon (a fungicide disinfectant of seeds)	489,3	652,3	1285,3	1120,3
Gibberellin+ Raxon	550,3	675,3	1325,1	1169,7
Melafen10^{-7}%+ Raxon	620,3	712,3	1423,6	1100,3
Melafen10^{-8}%+ Raxon	583,6	732,6	1285,3	1185,9
Pyrafen10^{-7}%+ Raxon	605,6	700,2	1368,2	1200,9
Pyrafen10^{-8}%+ Raxon	536,9	726,8	1257,2	1087,9

Accumulation of dry matter results from the process of assimilation and determines the cropping power of plants [2].

Proceeding from the data of table 2 it is clear that the similar picture is observed with accumulation of dry matter. Treatment of seeds with compounds consisting of growth regulators with fungicide contributes to a greater accumulation of dry weight throughout all phases of development. At the same time it is possible to distinguish the same variants - melafen10^{-7}+ Raxon and pyrafen10^{-7} + Raxon. In these variants accumulation of dry weight exceeds the variant with a fungicide disinfectant in 1,08-1,2 times.

Table 2 –Dynamic pattern of dry matter accumulation by winter wheat plants , g/10 plants

Variant	Development stage			
	tillering	booting	ear formation	milky ripeness
Control	4,00	16,82	38,32	65,26
Gibberellin	4,21	19,00	42,13	73,17
Melafen 10-7%	4,32	20,56	45,62	80,12
Melafen 10-8%	4,18	19,93	42,65	72,15
Pyrafen 10-7%	4,42	21,00	45,36	76,33
Pyrafen 10-8%	4,31	19,62	42,86	74,68
Raxon (a fungicide disinfectant	4,12	18,87	41,83	75,86

ISSN: 0975-8585

of seeds)				
Gibberellin+ Raxon	4,29	20,37	44,35	85,12
Melafen10-7%+ Raxon	4,46	22,03	47,46	85,69
Melafen10-8%+ Raxon	4,31	21,48	45,63	87,23
Pyrafen10-7%+ Raxon	4,44	21,86	46,92	88,21
Pyrafen10-8%+ Raxon	4,19	21,08	45,62	81,23

Our studies demonstrate that net productivity of photosynthesis fluctuates (NPP) in development phases and the greatest value falls on the period booting – ear formation (tab. 3). It should be noted that in variants of combined action of growth regulators and a fungicide disinfectant, NPP exceeds the values in variants without the use of fungicide. It means that in these variants the best conditions have been established for growth and development.

However it is necessary to note also a positive influence of growth regulators which also contribute to intensive strengthening of plant growth and development processes.

Table 3- Net photosynthesis productivity of winter wheat, g/m^{2}.*a day

Variant	Development stage		
	tillering booting	booting ear formation	ear formation milky ripeness
Control	10,79	34,39	16,92
Gibberellin	11,76	34,67	17,89
Melafen 10^{-7}%	11,80	36,66	19,13
Melafen 10^{-8}%	11,79	35,87	17,34
Pyrafen 10^{-7}%	11,84	34,59	16,88
Pyrafen 10^{-8}%	11,24	36,09	19,24
Raxon (a fungicide seed disinfectant)	11,74	33,86	18,86
Gibberellin+ Raxon	11,93	34,25	21,79
Melafen10^{-7}%+ Raxon	11,99	34,01	20,20
Melafen10^{-8}%+ Raxon	11,86	34,20	22,44
Pyrafen10^{-7}%+ Raxon	12,12	34,63	21,43
Pyrafen10^{-8}%+ Raxon	12,15	35,35	20,25

The greatest yielding capacity without treatment with a disinfectant is obtain in the variant - pyrafen10^{-7} % where the yielding capacity is higher than in control by 0,5 t/hectare with yield in control - 2,9t/hectare that is 17,2% in comparison with the control variant.

Application of a fungicide combined with these growth regulators also led to an increase in yields, and the considerable increase is observed in the variants -pyrafen 10^{-7}%+Raxon where yielding capacity is higher, than in the variant with application of Raxon by 11% and higher than in control by 21,4% (tab. 4).

The data presented in table 4 are processed by the two-factor analysis of variance. Growth regulators were taken as the first factor (A) and a seed disinfectant (B) was taken as the second factor. The studies show: the influence of the first factor is 23,9%, of the second factor is 56,2%. Thus, a complex seed treatment with growth regulators and a seed disinfectant is a strong factor in view of the yield increment.

Table 4 – Yielding capacity of winter wheat for the years of studies, t/ha

Variant	t/ha	An increment to control	
		t/ha	%
Control	2,90	-	-
Gibberellin	3,27	0,37	+11,8
Melafen 10^{-7}%	3,33	0,43	+14,8
Melafen 10^{-8}%	3,25	0,35	+12,0
Pyrafen 10^{-7}%	3,40	0,50	+17,2
Pyrafen 10^{-8}%	3,30	0,40	+13,8
Raxon (a fungicide seed disinfectant)	3,17	0,27	+9,3
Gibberellin+ Raxon	3,43	0,26	+18,2
Melafen10^{-7}%+ Raxon	3,50	0,33	+20,6
Melafen10^{-8}%+ Raxon	3,47	0,30	+19,6
Pyrafen10^{-7}%+ Raxon	3,52	0,35	+21,4
Pyrafen10^{-8}%+ Raxon	3,45	0,63	+18,9
$LSD_{0,5}$ for the first factor (A)	0,05		
$LSD_{0,5}$ for the second factor (B)	0,09		

Thus, the combination of growth regulators and a fungicide contributes to the assimilatory surface increase, dry matter accumulation and have a high stimulating effect on net productivity of photosynthesis and eventually can make an important contribution to an additional increase of winter wheat yielding capacity which substantiates the importance of applying these compounds.

REFERENCES

[1] Dospekhov, B. A. A field experiment technique (with fundamentals of statistical processing of research results).-5th edition, revised and updated. - M.: Agropromizdat. - 1985. - 351 pages.

[2] Isaev, R. F. The use of fungicides with growth regulators to increase yielding capacity of wheat / R. F. Isaev, F. M Shakirova, M. V. Bezrukova, A. R. Sakhabutdinova, R. A. Fatkhutdinova, A. M. , Ch. R. Allagulova, D. R. Maslennikova//Agrarian science. - 2005. - No. 4. – pp. 26-27.

[3] Kostin, V. I. Elements of mineral nutrition and growth regulators in ontogenesis of crops / V. I. Kostin, V. A. Isaichev, O. V. Kostin. - M. Kolos. - 2006. – 290 pages.

[4] Provalova, E.V. The use of new generation growth regulators for the purpose of increasing grain yield of winter wheat / E.V. Provalova, A. L. Toygildin, Yu. V. Ermoshkin, S.E. Erofeyev, N. V. Khvostov, O. N. Tsapovskaya//Research Journal of Pharmaceutical, Biological and Chemical Sciences. - November - December 2015 RJPBCS 6(6) Page No. 117.

[5] Tretyakov, N. N. A manual on plant physiology / N. N. Tretyakov, T. V. Karnaukhova, L. A. Panichkin, etc. - the 3d edition, revised and updated - M.:Agropromizdat. - 1990. - 217 pages.