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THE CONTENT OF PROTEIN AND GLUTEN IN WINTER TRITICALE GRAIN USING BIOLOGICALLY ACTIVE SUBSTANCES

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The results of research on the influence of biologically active substances (different norms of herbicides Prima and Puma Super using separately and in tank mixtures with plants growth regulator of natural origin Biolan) on the formation of protein and gluten content in winter triticale grain are presented.

***Keywords**: winter triticale, herbicide, plants growth regulator, protein, gluten.*

Nowadays, a global problem is the lack of protein. With the introduction of high-yielding varieties of wheat in production, increased gross grain harvest, but abruptly reduced the content of protein in it. Therefore, in terms of solving the problem of plant protein, undoubted interest is the relatively new culture of triticale. Numerous studies have found a high value of triticale due to its chemical content of seed. Triticale seed contains more protein than in the parental forms: wheat and rye. This is according to scientists who associate such feature of triticale with increasing of specific weight of covering, resulting hydrolysis of fine grain starch and grain surface deformation [1 – 3].

The most important indicators of the quality of grain – protein content, gluten quantity and quality depends on several factors: weather conditions, variety, use of plant protection products, including herbicides and plant growth regulators.

Recently, because of the significant environmental pollution that occurred as a result of uncontrolled use of pesticides and fertilizers, a search for alternative agricultural systems is actual. The practice of intensive modern farming requires substantial additions and increasing of protective action of agro-measures with other methods that did not acquire completeness and have significant reserves for improvement [4, 5]. Their basis is Biologization, which anticipates constraints and in the future – the rejection of the use of pesticides, especially under unfavorable environmental conditions Exactly to such biological means belong plant growth regulators (PGR) which increase the resistance of crops to diseases, pests, and are also an important factor in regulating the course of physiological processes in cultivated plants and microbiological – in the soil, which directly affect the yield and quality of grown crops and ultimately determine the effectiveness of all agrotechnical measures.

Studies of recent years indicate that the use of PGR reduces the negative impact of herbicides on cultivated plants [6 – 8], the increase of grain yield (5 – 8%) and wet gluten in it at the same time increases to 5,2 – 7,4% [9]. However, the question of joint action of herbicides and PGR on protein and gluten content in winter triticale grain is not enough studied, which helped us to define the task and goal of our research.

Research methodology. Experiments were performed in the field and laboratory conditions in Uman NUH. Herbicide Prima (florasulam (6,25 g/l) + ethylhexyl ester 2,4-D (452,42 g/l)) in norms 0,4; 0,6; 0,8 and 1.0 l/ha, and Puma

Super (fenoxaprop-p-ethyl, 69 g/l + antidote) – 0,8; 1,0; 1,2 and 1,4 l/ha was supplied in phase of full tillering of culture separately and in combination with PGR Biolan (phytohormones of auxin, gibberellin and cytokinin nature, amino acids, carbohydrates, fatty acids and trace elements) in the norm of 10 ml/ha according to the scheme shown in Tables 1 and 2. Expense of working solution was 300 l/ha. The protein and gluten content were determined by ISO 4762: 2007 [10] in samples of grain which was gathered in the field conditions by direct harvesting, and was brought to standard humidity.

Results of investigation. As a result of conducted research, found that depending on the herbicide and the PGR action, in winter triticale grain agglomerated different amount of protein. Thus, on the average during years of research using Prima, grain protein content was the highest in the variant of the experiment with norm 0,8 l/ha of preparation and was 14,7% at 13.6% in control (Table 1). By supplying a PGR Biolan, the average of protein content over three years was 14,1%.

1. The protein content of winter triticale grain (%) by spraying crops with herbicides Prima and Puma Super separately and together with PGR Biolan

Variant of experiment	2005	2006	2007	Avarage for 3 years
Without preparations (control)	13,7	14,9	12,2	13,6
Biolan 10 ml/ha	14,2	15,2	13,0	14,1
Prima 0,4 l/ha	14,1	15,2	12,9	14,1
Prima 0,6 l/ha	14,4	15,2	13,2	14,3
Prima 0,8 l/ha	14,8	15,3	13,9	14,7
Prima 1,0 l/ha	14,0	15,1	12,5	13,9
Puma Super 0,8 l/ha	14,0	15,2	12,6	13,9
Puma Super 1,0 l/ha	14,1	15,2	12,8	14,0
Puma Super 1,2 l/ha	14,3	15,2	13,1	14,2
Puma Super 1,4 l/ha	13,9	14,9	12,4	13,7
Prima 0,4 l/ha + Biolan 10 ml/ha	14,7	15,4	13,8	14,6
Prima 0,6 l/ha + Biolan 10 ml/ha	15,0	15,5	14,5	15,0
Prima 0,8 l/ha + Biolan 10 ml/ha	15,4	15,8	14,7	15,3
Prima a 1,0 l/ha + Biolan 10 ml/ha	14,5	15,2	13,4	14,4
Puma Super p 0,8 l/ha + Biolan 10 ml/ha	14,6	15,2	13,5	14,4
Puma Super 1,0 l/ha + Biolan 10 ml/ha	14,6	15,2	13,7	14,5
Puma Super 1,2 l/ha + Biolan 10 ml/ha	14,8	15,3	14,3	14,8
Puma Super 1,4 l/ha + Biolan 10 ml/ha	14,4	15,1	13,3	14,3
HIP_{05}	*0,49*	*0,50*	*0,49*	

Applying of Prima together with PGR Biolan provided increase of the protein content in the grain of winter triticale in all variants of the experiment, however, much higher amount was in variants using the 0,6 and 0,8 l/ha of preparation, which was 15,0 and 15,3%, respectively.

Adding herbicide Puma Super in norms of 0,8; 1,0; 1,2 and 1,4 l/ha caused the increase of protein content of grain compared to before the control, to 2, 3, 4, and 1%.

Joint adding of Puma Super and PGR Biolan also provided the increase of protein content of winter triticale grain. However, the highest it was in the variant of adding of 1,2 l/ha of preparation with Biolan, which exceeded the control on 9%.

Effect of studied herbicides, which were added separately and together with PGR Biolan, on wet gluten content in grain of triticale, which is also one of the most important indicators of the quality of grain, was diverse (Table 2).

2. Wet gluten content of winter triticale grain (%) by spraying crops with herbicides Prima and Puma Super separately and together with PGR Biolan

Variant of experiment	2005	2006	2007	Avarage for 3 years
Without preparations (control)	24,1	25,2	21,7	23,7
Biolan 10 ml/ha	25,0	26,1	22,5	24,5
Prima 0,4 l/ha	24,8	26	22,4	24,4
Prima 0,6 l/ha	25,2	26,3	22,7	24,7
Prima 0,8 l/ha	25,5	26,6	23,5	25,2
Prima 1,0 l/ha	24,4	25,6	22,0	24,0
Puma Super 0,8 l/ha	24,5	25,8	22,1	24,1
Puma Super 1,0 l/ha	24,6	25,8	22,3	24,2
Puma Super 1,2 l/ha	25,1	26,2	22,6	24,6
Puma Super 1,4 l/ha	24,2	25,3	21,8	23,8
Prima 0,4 l/ha + Biolan 10 ml/ha	25,5	26,5	23,4	25,1
Prima 0,6 l/ha + Biolan 10 ml/ha	26,0	27,1	24,2	25,8
Prima 0,8 l/ha + Biolan 10 ml/ha	26,6	27,5	24,6	26,2
Prima a 1,0 l/ha + Biolan 10 ml/ha	25,4	26,4	23,0	24,9
Puma Super p 0,8 l/ha + Biolan 10 ml/ha	25,4	26,5	23,1	25,0
Puma Super 1,0 l/ha + Biolan 10 ml/ha	25,4	26,5	23,3	25,1
Puma Super 1,2 l/ha + Biolan 10 ml/ha	25,6	26,6	23,7	25,3
Puma Super 1,4 l/ha + Biolan 10 ml/ha	25,3	26,4	22,9	24,9
HIP $_{05}$	*0,61*	*0,68*	*0,57*	

Thus, applying of Puma Super in norms of 0,8; 1,0; 1,2 and 1,4 l/ha wet gluten content increased to 2, 2, 4, and 0,4% according to control. The use of plant growth regulator helped to increase the wet gluten content in grain to 3%. In variants with Prima, the highest wet gluten content was in the variant with norm of the preparation 0,8 l/ha, which exceeded the control on 6%.

The highest gluten content was in variants using 0,8 l/ha of Prima together with Biolan, it was 26,2% versus 23,7% in the control and – using Puma Super in norm of 1,2 l/ha together with Biolan, which exceeded the control on 7%.

Conclusions. Accordingly, the obtained experimental data allows us to conclude that the studied herbicides Prima and Puma Super and PGR Biolan as biologically active substances, have a significant influence on the formation of protein and gluten content in grain of winter triticale. However, the highest quality indicators of protein and gluten content of grain formed in variants with joint adding of herbicides and PGR: Prima in norm of 0,8 l/ha and Puma Super – 1,2 l/ha with Biolan – 10 ml/ha.

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Содержание белка и клейковины в зерне тритикале озимого при использовании биологическиактивных веществ

Установлено, что гербициды Прима и Пума супер, внесенные раздельно и совместно с регулятором роста растений Биолан, значительно влияют на содержание белка и клейковины в зерне тритикале озимого. Тем не менее, наиболее высокие показатели белка и клейковины формируются в вариантах опыта с внесением гербицидов Примы (0,8 л/га) и Пумы супер (1,2 л/га) в смеси с регулятором ростарастений Биолан.

Ключевые слова: *тритикале озимое, гербицид, регулятор роста растений, белок, клейковина.*

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The content of protein and gluten in winter triticale grain using biologically active substances

It was found that herbicides Prima and Puma Super added separately and together with the plant growth regulator Biolan, significantly affect the content of protein and gluten of winter triticale grain. Nevertheless, the highest index of protein and gluten form during the experiments with impurity of Prima herbicide (0,8 l / ha) and Puma Super herbicide (1.2 l / ha) in admixture with a plant growth regulator Biolan.

Keywords*: winter triticale, herbicide, plant growth regulator, protein, gluten.*