GLUTEN CONTENT IN THE GRAIN OF SPRING TRITICALE DEPENDING ON NITROGENOUS NUTRITION

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The results of the scientific research are dealt with the effect of the rates of fertilizer and weather conditions on the formation of gluten in the grain of spring triticale, index of gluten deformation, extensibility and hydration capacity.

Key words: *spring triticale, protein, gluten, hydration capacity*.

Spring triticale plays an important role in increase of producing goods under the conditions of reducing energy supply consumption. The great content of the protein and balanced state of amino acid structure in the wheat grain gives an opportunity to use it as bread-grain, industrial crop and feed grain [8, 9].

The value of the wheat grain is defined by its capability to give an output of high-quality [5]. Protein and gluten and their qualities don't only increase nourishing value of bakery products but also the power of flour and organoleptic property [6].

Gluten in triticale flour is of great quality that is why it is often used as a component for making low quality wheat mixtures. Thus, if the general baking rating of the flower of six class wheat makes up 2.1 points and the rating of triticale comprises 4.6 points the general rating of bread after their mixing makes up 5.0 points [1].

It is well known that the baking qualities of bread aren't always defined by the quantity of gluten in its content. Loose correlative connection between the quantity of gluten and the number of sedimentation proved scientifically by Ryadchykov makes up 0.10 – 0.22 [4]. Nevertheless the given results confirm the dependence of technological qualities of wheat grain from the quality of gluten.

Domestic grain varieties of triticale are good for forming qualitative grain and gluten of high baking qualities in comparison with other worse forerunners grown in the Forest-steppe area as well as in the Forest area in Ukraine [1].

Sorted inherited characteristics which depend on soil and weather conditions serve as the indices of grain quality. It is well known that the conditions of grain crops nutrition including spring triticale don't only influence corn cropping but the crop quality as well. Fertilizing soil by different rates of nitrogen nutrition at different periods of time change the conditions of feeding plants [7].

Methods of the research. The investigation was carried out on the podzolic heavy loamy black earth (chernozem) of the pilot section of Uman National University of Horticulture during the period of 2008 – 2010. The experiment was held according to the scheme presented in the table. The soil was enriched by phosphatic and potash fertilizer in the process of its main tillaging. Nitrogen fertilizer was applied in spring before presowing cultivation.

Agricultural methods of growing spring triticale are standard for the Right-bank Forest-steppe of Ukraine. In our investigation spring triticale of the sort Khlibodar (Breadgift) of Kharkiv was grown on the same soil after cropping spring barley.

The general area of the section was 72 m², accounting one made up 40 m². The experiment was held three times. The sections under the investigation were placed in consecutive order.

Mathematical treatment of experimental materials was done with the help of the method of dispersive analysis of single factor field experiment making use of the package of the standard programme "Microsoft Exel 2003".

Weather conditions over the period of carrying out the investigation were unstable in comparison with the average indices of many years. In 2008 weather conditions were more convenient for growth and development of spring triticale even if the number of atmospheric precipitation during the vegetative period made up 184.1 mm which was less in 1.5 times in comparison with average indices of many years. At the beginning of 2009 the heat was not intense in growing and the frequency of atmospheric precipitation was irregular during the vegetative period. In general the weather conditions were favourable for gathering the rich harvest of spring triticale even if the number of atmospheric precipitation from April to July made up 173.6 mm which was less in 1.6 times in comparison with average indices of

many years. In 2010 the number of atmospheric precipitation was sufficient but from April to July its number made up 294.3 mm which was 1.1 times bigger than the norm but the temperature and the soil at the beginning of spring triticale grain's growing and developing caused getting poor harvest in comparison with that one of 2009.

The results of the research. The average content of gluten in the flour made of spring varieties of triticale ranged from 19.0 to 24.5 % which was lower than wheat flour had. It is known that the quality of bread is defined by physical characteristics rather than the number of gluten. Even a small amount of high plastic indices of gluten in the content helps us bake the bread of high quality [2].

According to the research data introduced by B. P. Pleshkov, A.F. Shulyndin and I.P. Yemelyanova fertilizers aren't always favourable for the improvement of cereal crops quality. It is caused by weather conditions. Growing triticale under the conditions of low temperature and increased number of atmospheric precipitation the content of nitrogen within the grain was 2 – 4% lower than in the grain grown under the conditions of drying year.

During three years of the investigation the average gluten content in the grain of spring triticale grown without fertilizers made up 18.1%. As a result of applying for about 30 – 180 kg/ha of nitrogen fertilizer it grew up to 20.2 – 25.7% against the background of P12K120 or just to 12 – 40% in comparison with standard (table 1).
It is worth while admitting that applying N210 didn't change the content of gluten at all in comparison with N180 but this index was changed year by year during the period of the investigation. Thus in 2008 the content of gluten ranged from 17.7 to 28.3%, in 2009 – from 21.6 to 29.6%, in 2010 – from 14.9 to 19.5% which is in comparison with *HIP05 =1 – 1.3* meant essentially.

During the period of 2008 – 2010 the average gluten of spring triticale was of good quality so far as the indices of deformation ranged from 68 to 70 items which measured up the first group of quality (table 2).

1. Gluten content in the grain of spring triticale depending on various rates of nitrogen fertilizer, %

Variety	Year of research			Arithmetical mean
	2008	2009	2010	
Without applying fertilizers (standard)	17,7	21,6	14,9	18,1
$P_{90}K_{90}$ – (background)	18,8	22,4	14,8	18,7
Background + N_{30}	22,7	22,8	15,0	20,2
Background + N_{60}	24,9	23,2	15,7	21,3
Background + N_{90}	27,0	24,8	16,5	22,8
Background + N_{120}	27,4	25,6	17,5	23,5
Background + N_{150}	28,3	25,6	18,3	24,1
Background + N_{180}	27,8	29,2	19,2	25,4
Background + N_{210}	27,9	29,6	19,5	25,7
$ANOVA_{05}$	*1,1*	*1,3*	*1,0*	

Applying nitrogenous fertilizers under various weather conditions of vegetation period of spring triticale influenced the indices of triticale elasticity. Thus in 2008 the index of deformation in the variant without fertilizers was 75 items. On increasing the rate of nitrogenous fertilizers to 210 kg/ha the index of deformation decreased to the point of 70 items.

In 2009 it grew from 70 items to 75 items. And in 2010 it was unchanged and for about 60 – 63 items.

During three years of carrying out the investigation the average extensibility of gluten without applying fertilizer made up 19 sm. In case of applying various proportions of nitrogen fertilizer this index was ranged from 19 to 22 sm and during the investigation it ranged from 19 to 23 (table 3).

2. Index of deformation of spring triticale grain depending on various rates of nitrogen fertilizer, items (it.)

Variety	Year of research			Arithmetical mean
	2008	2009	2010	
Without applying fertilizers (standard)	75	70	60	68
$P_{90}K_{90}$ – (background)	75	70	60	68
Background + N_{30}	75	70	60	68
Background + N_{60}	75	70	60	68
Background + N_{90}	73	75	62	70
Background + N_{120}	70	75	63	69
Background + N_{150}	70	75	63	69
Background + N_{180}	70	75	60	68
Background + N_{210}	70	75	60	68
$ANOVA_{05}$	*4*	*5*	*3*	

3. Extensibility of spring triticale grain depending on various rates of nitrogen fertilizer, sm

Variety	Year of research			Arithmetical mean
	2008	2009	2010	
Without applying fertilizers (standard)	18,0	20	20	19
$P_{90}K_{90}$ – (background)	20,0	21	21	21
Background + N_{30}	19,5	20	20	20
Background + N_{60}	19,0	20	20	20
Background + N_{90}	19,0	19	19	19
Background + N_{120}	22,0	21	21	21
Background + N_{150}	20,0	23	23	22
Background + N_{180}	23,0	19	19	20
Background + N_{210}	23,0	20	20	21
$ANOVA_{05}$	*1*	*1*	*1*	

4. Hydration value of spring triticale gluten depending on various rates of nitrogen fertilizer, %

Variety	Year of research			Arithmetical mean
	2008	2009	2010	
Without applying fertilizers (standard)	195	203	184	194
$P_{90}K_{90}$ – (background)	192	200	185	192
Background + N_{30}	190	191	180	187
Background + N_{60}	189	194	185	189
Background + N_{90}	191	195	184	190
Background + N_{120}	192	196	180	189
Background + N_{150}	192	196	180	189
Background + N_{180}	193	196	180	190
Background + N_{210}	192	198	184	191
$ANOVA_{05}$	*10*	*11*	*9*	

Gluten of spring triticale is characterized by high hydration value. That is why during three years of carrying out the investigation without applying fertilizer the average index was 194%. Application of nitrogen fertilizer reduced its hydration value depending on the proportion of nitrogen fertilizer to 187 – 192 %. (table 4).

During the whole period of carrying out the investigation this index was changed: it was the highest one and ranged from 191 to 203 % in 2009, it was the lowest one in 2010 with the rating of 180 – 185 %. Besides, in 2008 it was 189 % - 195 %. It is worth while defining that hydration value of gluten during the years of the investigation was the biggest one in case of avoiding fertilizer.

The conclusions

1. Being deprived of nitrogen fertilizer crops of spring triticale are characterized by low content of gluten but at the same time by high elasticity (IDC == 68 – 70 items), hydration value and average extensibility.

2. The content of gluten depends on the weather conditions of the vegetative period: low humidity of air, high temperature and lack of moisture in the soil which in comparison with warmer vegetative period during the vegetation period influences the increase of protein within the crop content. These indices can be essentially raised by means of optimizing the conditions of nitrogenous nutrition.

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ВМІСТ КЛЕЙКОВИНИ В ЗЕРНІ ТРИТИКАЛЕ ЯРОГО ЗАЛЕЖНО ВІД РІВНЯ АЗОТНОГО ЖИВЛЕННЯ

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Наведено результати досліджень впливу різних норм азотних добрив і погодних умов на формування вмісту клейковини в зерні тритикале ярого, індекс деформації клейковини, розтяжність і гідратаційну здатність

Ключові слова: *тритикале яре, клейковина, гідратаційна здатність*

Количество клейковины в зерне тритикале ярового в зависимости от уровня азотного питания

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Приведены данные исследований влияния разных норм азотных удобрений и погодных условий на содержание клейковины в зерне тритикале ярового, индекс деформации клейковины, растяжимость и гидратационную способность

Ключевые слова: *тритикале яровое, клейковина, гидратационная способность*