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ASSIMILATION OF NITROGEN NUTRITION OF WINTER WHEAT PLANTS WHEN USING AKM GROWTH REGULATOR

V.V. KALITKA, Doctor of Agricultural Sciences

Z.V. Zolotukhina, assistant

Tavria state agrotechnological university

It has been determined that application of AKM growth regulator for pre-sowing seed treatment and treatment of vegetating winter wheat plants contributed to nitrogen contents increase in vegetative mass during the whole studied vegetation period. At the same time, this agromeasure stimulated the process of nitrogen absorption from the soil and fertilizers as well as its reutilization from vegetative to productive parts of the plant.

Keywords: *winter wheat, growth regulator, variety, nitrogen contents, nitrogen assimilation.*

World practice shows that winter wheat yield increases along with optimization of resource provision, fuller use of genetic potential of varieties, maximum adaptation of cultivation technology to variety demands and soil and climate conditions of the zone [8]. However, at the current stage of agricultural production development, production of high-quality winter wheat grain is impossible without rational use of fertilizers, especially nitrogen ones [6]. In spite of that, the effectiveness of nitrogen assimilation of grain crops is still low. Partly, this fact can be explained by non-optimal climatic conditions during vegetation, but the main reason is still the imperfect of plant nutrition system. That is why nowadays the question of development of highly productive technologies of nitrogen assimilation effectiveness increase by winter wheat plants, taking physiological demands of the variety, is of the utmost importance.

Implementation of new-generation growth regulators (GR) is one of the elements of the modern intensive technology of grain crops cultivation. The results of

the studies show that new GR are able to increase both the yield of main field crops (by 10-30%) and quality of the product [1]. However, the influence of GR on nitrogen nutrition of winter wheat plants is not fully studied.

That is why **the goal of the research** was optimization of nitrogen nutrition of the plants of intensive winter wheat varieties in conjunction with AKM growth regulator application.

Materials and methods of the research. The research was held during 2009-2012 in the stationary experiment of Crop science department in education and production centre of Tavria state agrotechnological university. Soil of the research field is southern lightly clayey chernozem. Contents of humus in the arable layer is 2.91-3.68%, hydrolysable nitrogen 80.0-98.0 mg/kg of the soil, mobile phosphorus – 138.1-158.0 mg/kg of the soil, exchangeable potassium – 165.8-180.0 exchangeable potassium, soil solution reaction is close to neutral (pH = 6.5-6.7).

Two-factor field experiment was held using the scheme:

Factor A. Growth regulator:

1. control (no GR);
2. AKM.

Factor B. Variety:

1. Zolotokolosa;
2. Antonivka;
3. Tytona.

Pre-sowing seed treatment was done 1-2 days before sowing using incrustation method at the rate of 10 l of working solution for 1 t of the seeds. Rate of application of AKM growth regulator is 0.33 l/t of the seeds. During vegetation period the plants were treated in the booting and in the grain ripening stages with AKM preparation (0.33 l/t) at the rate of 200 l/ha of working solution. During the sowing full mineral fertilizer was applied for all variants – nitroammophoska with the dose of $N_{12}P_{12}K_{12}$. For top-dressing in the early spring 100 kg/ha of ammonium nitrate was used (N_{34}).

Bare fallow occupied the field the year before winter wheat in the crop rotation. Soil management and filed preparation for the sowing was done according to the scheme, commeon for the Southern Steppe of Ukraine [3]. Seeds were sown in the first ten-day period of October in to well-prepared soil using standard row width, depth of sowing – 5-6 cm, rate of sowing – 5.0 million seeds per ha. During tillering

stage Granstar herbicide was applied (0.02 kg/ha). During booting stage Forceage 500CS fungicide was applied (0.5 l/ha). For pest protection BI-58 New (1.5 l/ha) insecticide was used.

Contents of nitrogen in plant material were determined using Kjeldahl method, the coefficient of nitrogen reutilization into the grain from vegetative organs was calculated using the A.D. Kiriziy formula [4]. Statistical handling of the results of the research was done using dispersive and correlation-regression methods using „MS Office 2007" and „Agrostat New" software.

Results of the research and their analysis. It is known that contents of protein in the grain depends on genotype features and provision of the plants with nitrogen which in turn are connected with the intensity of growth processes that are based on the productivity of photosynthetic apparatus and the ability of the root system to absorb the nitrogen from the soil and fertilizers.

In order to prevent the decrease of protein contents, the yield increases should be combined with the increase of nitrogen absorption and the effectiveness of its use for protein biosynthesis [9]. Protein accumulation in the grain takes place on the account of use of two sources of nitrogenous compounds: reutilization of nitrogen that was accumulated in the vegetative organs (mostly leaves and stems) before the bloom, and absorption of nitrogen from the soil during grain ripening [5,7].

The results of the research show that accumulation of nitrogen in winter wheat plants depended on variety features and weather conditions during the vegetation. The biggest contents of nitrogen in the plants was noted in 2010 and 2012, while it was lesser in 2011. However, the dynamics of nitrogenous compounds accumulation at different development stages had the same tendency during all years of research (Fig.).

Maximum contents of nitrogen (3.9-4.4%) in the control variants for the plants of all varieties was accumulated before booting stage. At the beginning of reproductive organs formation (bloom stage) contents of nitrogen in vegetative organs started to gradually decrease, with a steep decrease of its contents during grain ripening, which is connected to its reutilization process to the grain.

Low nitrogen assimilation by the plants of Tytona variety should be noted. Contents of nitrogen in the vegetative organs of the plants of this variety during all development stages was 0.5-1.4% lesser compared to Zolotokolosa and Antonivka varieties.

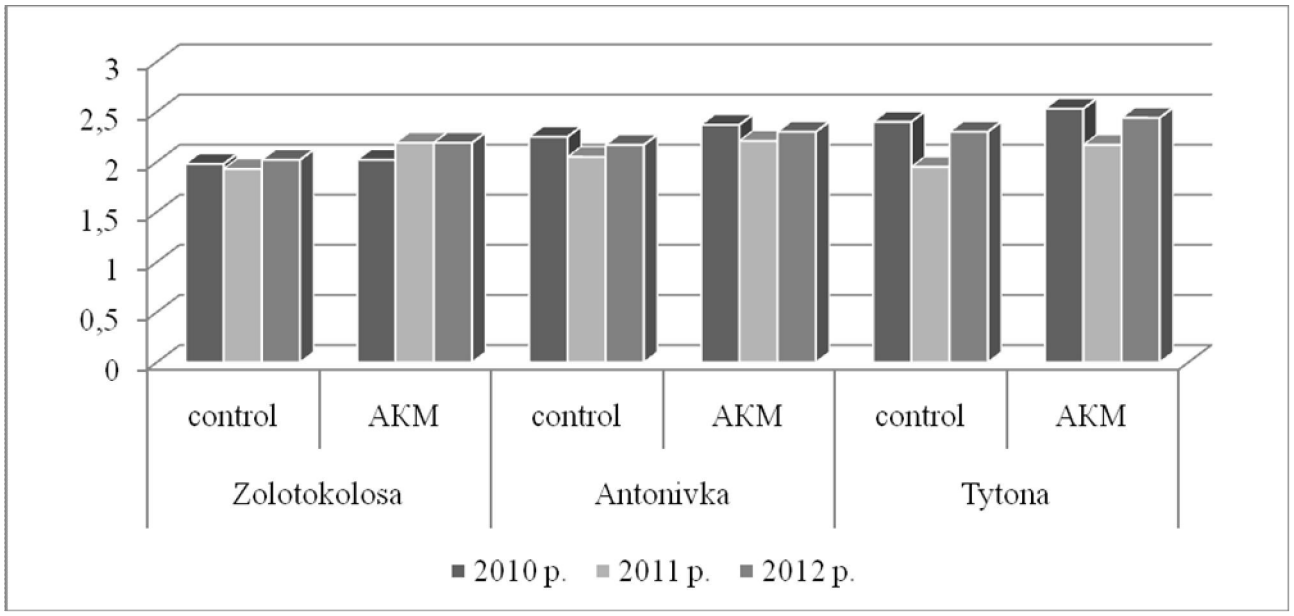

Fig. Dynamics of nitrogen contents in winter wheat plants depending on the effect of growth regulator, mean for 2010-2012.

Application of AKM growth regulator contributed to the increase of nitrogen contents in the plants of all varieties during the whole studied vegetation period. What is more, for this index, GR had the highest influence on Zolotokolosa variety, for which mean increase of nitrogen contents during the vegetation from AKM application was 0.85%.

Coefficient of nitrogen assimilation by winter wheat plants differed for different varieties and depended on weather conditions of the year (table 1). The highest value of this index (57-68%) was noted during favorable hydrothermal conditions of 2011, when adequate amount of moisture contributed to maximum nitrogen absorption by the root system of the plants. Assimilation of nitrogenous substances greatly decreased because of moisture deficit during vegetation periods of 2010 and 2012. It should be also noticed that Antonivka variety had the most stable nitrogen absorption regardless of weater conditions, its nitrogen absorption

coefficient during the three years varying from 30 to 57%. At the same time, Zolotokolosa variety had the highest variabilty of this index, varying from 18-20% in stress conditions of 2010 and 2012 to 68% in favorable 2011.

1. Coefficient of nitrogen absorption by winter wheat plants depending on the effect of growth regulator, %

Variety (factor B)	GR (factor A)	2010	2011	2012	Mean value for 2010-2012	C_V, %
Zolotokolosa	control	18	68	20	35	81
	AKM	22	85	25	44	81
Antonivka	control	50	57	30	46	30
	AKM	63	69	39	57	28
Tytona	control	29	68	42	46	43
	AKM	53	91	64	69	28
LSD_{05}, for:	factor A	8,6	8,0	6,2	2,7	-
	factor B	3,6	3,7	3,3	1,9	-

Application of AKM growth regulator led to better absorption of nitrogen that showed itself in the increase of the coefficient of nitrogenous substances assimilation by winter wheat plants by 9-23% compared to control. What is more, the biggest effect from using this agromeasure was observed for Tytona variety, for which this index had an average 23% increase during the years of the research, compared to the va variant without using GR.

For further analysis of the features of nitrogen exchange of the plants of intensive winter wheat varieties, the coefficient of nitrogen reutilization into the grain was used [2]. This coefficient shows which part of the nitrogen that was accumulated in ripe grain, was reutilized from vegetative organs of the plants.

Obtained data shows that nitrogen accumulation in the grain of control variants of all studied varieties in the stage of milky ripeness was done almost equally by its active absorption from the soil and fertilizers, as well as by reutilization from vegetative organs of the plant (table 2).

2. Coefficient of nitrogen reutilization from winter wheat vegetative stems into the grain during grain ripening, %

Variety (factor B)	GR (factor A)	2010	2011	2012	Mean value for 2010-2012
Zolotokolosa	control	61	62	59	61
	AKM	94	87	87	89
Antonivka	control	49	54	51	51
	AKM	89	95	92	92
Tytona	control	58	72	61	64
	AKM	63	74	66	68
LSD_{05}, for:	factor A	2,5	7,2	5,4	1,0
	factor B	5,0	5,0	3,7	2,5

The lowest value of the reutilization coefficient was characteristic for Antonivka variety.

Application of AKM growth regulator stimulated reutilization process of nitrogen that was accumulated in the vegetative parts of the plant. It is proved by the increase of reutilization coefficient of nitrogen in average for the years of the research from 61 to 89% for Zolotokolosa variety and from 51 to 92% for Antonivka variety. This influence of GR was little for Tytona variety, so the increase of the protein contents for this variety was mainly done via the increase of the intensity of absorption of nitrogenous compounds from the soil and fertilizers (table 1).

Conclusions

So, the use of AKM growth regulator in the technology of growth of winter wheat led to more intensive nitrogen accumulation during the earlier stages of plant development via the increase of coefficient of absorption from the soil and fertilizers with active later reutilization of nitrogenous substances into the grain that lead to the increase of protein contents in the grain.

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ЗАСВОЄННЯ АЗОТУ РОСЛИНАМИ ІНТЕНСИВНИХ СОРТІВ ПШЕНИЦІ ОЗИМОЇ ЗА ВИКОРИСТАННЯ РЕГУЛЯТОРА РОСТУ АКМ

В.В. КАЛИТКА, доктор сільськогосподарських наук

З.В. ЗОЛОТУХІНА, асистент

Таврійський державний агротехнологічний університет

Встановлено, що використання регулятора росту АКМ для передпосівної обробки насіння і вегетуючих рослин інтенсивних сортів пшениці озимої сприяло зростанню вмісту азоту у вегетативній масі протягом усього досліджуваного періоду вегетації за рахунок активізації процесу поглинання його із ґрунту і добрив. Застосування цього агроприйому стимулювало процес реутилізації азотистих речовин із вегетативних частин рослини до репродуктивних.

Ключові слова: *пшениця озима, регулятор росту, сорт, засвоєння азоту, реутилізація азоту.*

УСВОЕНИЕ АЗОТА РАСТЕНИЯМИ ИНТЕНСИВНЫХ СОРТОВ ПШЕНИЦЫ ОЗИМОЙ ПРИ ИСПОЛЬЗОВАНИИ РЕГУЛЯТОРА РОСТА АКМ

В.В. Калитка

З.В. Золотухина

Установлено, что использование регулятора роста АКМ для предпосевной обработки семян и вегетирующих растений пшеницы озимой способствовало увеличению содержания азота в вегетативной массе на протяжении всего исследуемого периода вегетации за сет активизации

процесса поглощения его из почвы и удобрений. Использование данного агроприема стимулировало процесс реутилизации азотистых веществ из вегетативных частей растения в репродуктивные.

Ключевые слова: *пшеница озимая, регулятор роста, сорт, усвоение азота, реутилизация азота.*