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VIRYCH P.A.
E-mail: Sphaenodon@ukr.net
VEDMEDENKO G.Y.
SCHWARTAU V.V., corresponding member of NAS of Ukraine
E-mail: Schwartau@ifrg.kiev.ua
Institute of Plant Physiology and Genetics, National Academy of Sciences of Ukraine

INFLUENCE OF TRINEXAPAC-ETHYN ON PIGMENT AND ANIONIC CONTENT OF WHEAT (*TRITICUM AESTIVUM* L.) FLAG LEAF

It has been shown that trinexapac-ethyl (Moddus, Syngenta; TE) increases of the chlorophyll content in the flag leaves of wheat, contributing to the photosynthesis intensifying. The reduction of the pool of basic inorganic anions induced by TE may be connected with its active assimilation by leaf cells.

Key words: *wheat, trinexapac-ethyl, chlorophyll, anions*

Introduction. Technology of cultivation of crops involve the use of chemical fertilizers, pesticides, growth regulators and other substances that can reveal potential of plants and protect them from harmful influences, as well as adverse environmental factors [1]. Deserve special attention derivatives of cyclohexandione class, among which are found and are widely used in crop graminicides and retardants [2, 3]. Among the herbicides mentioned inhibitors of acetyl-CoA carboxylase, which are effective in controlling the broad spectrum of annual and perennial monocotyledonous weeds. They cause the fast inhibition of growth with further necrosis meristems. In cyclohexanedione class was found retardant TE with 20-oxidase of gibberellic acid (GA) site of action. As a result, inhibited the synthesis of active forms of GA from its predecessors – suppressed linear growth of the plant, the thickens stem, which is particularly important for crops, which are susceptible to lodging [4].

Important indicator of the state plant is the content pigments in the photosynthetic active tissues. On the pigment content is influenced by many factors, and especially available for plant forms of nitrogen and phosphorus – the main macronutrients required for chlorophyll synthesis [5].

Our aim was to study TE effect on the amount of chlorophyll *a, b* and carotenoids, as well as on the amount of free form phosphates and nitrates in the wheat leaves.

Materials and methods. The object of research was winter-spring wheat (*Triticum aestivum* L.) varieties Zimoyarka (Institute of Plant Physiology and Genetics NAS of Ukraine). The experiments were conducted at the Experimental agriculture department of the Institute of Plant Physiology and Genetics, NAS of Ukraine in 2011-2013. 2013 data presented. Research scheme: 0.4 and 0.6 l / ha TE at an interval of 5 days 0.4 + 0.2 l / ha TE – additional treatment was carried out 5 days after the first treatment.

To determine the amount of pigments 50 mg of powdered flag leaf was dissolved in 10 ml of DMSO, ACS spectrophotometric grade. Extraction was done in a water bath (60°C) until plant material complete bleaching.

Determination was made on SP-26 spectrophotometer at a wavelength of 480, 649 and 665 nm. Calculations carried out by the formulas:

$$C_a = 12,19 * A_{665} – 3,45 * A_{649}$$

$$C_b = 21,99 * A_{649} – 5,32 * A_{665}$$

$$C_{carot} = (1000 * A_{480} – 2,14 * C_a – 70,16 * C_b) / 220,$$

where $C_{a,\ b,\ carot}$ – the concentration of chlorophyll *a, b* and carotenoids, respectively; A – figures spectrophotometer at appropriate wavelengths.

To determine the amount of basic inorganic anions homogenized 50 mg of dry leaves was dissolved in 15 ml of ultrapure water (Scholar-UV Nex Up 1000, Human Corporation, Korea) and extracted with a water bath (100°C) for 10 min, the extract was drained and carried this procedure three more times. The total amount of water - 50 ml (dilution 1:1000). The resulting solution was filtered (0.45 nm). In aliquote content of anions was determined by ion chromatograph IC PRO 881 Metrohm (Switzerland) with conductometric detector (range 0-15 000 mS /cm) and the column Metrosep A Supp 250x45, 0 mm, eluent – carbonate buffer 3.2 mM Na_2CO_3 + 1 mM $NaHCO_3$ (Merck, Germany). Pre-processing of results was performed using the Magic Net IC v. 1.1 Metrohm, statistical – Microsoft Exel 2010. Recalculation performed per gram of dry substance. Experiments were repeated three times, each variant had at least five analytical replicates.

Results and discussion. In processing of plants TE of 0.4 l/ha observed the significant increase in the amount of chlorophyll *a* in the 23% compared with the control, and carotenoids – 20% (Table 1).

Table 1

Pigments content in flag leaves of wheat variety Zimoyarka

Variants	Chlorophyll *a* (mg/ml)	Chlorophyll *в* (mg/ml)	Carotenoids (mg/ml)
Control	17,06±0,85	3,18±0,16	4,58±0,23
TE 0,4 + 0,2 (1)*	21,94±0,76	2,96±0,17	5,66±0,19
TE 0,4 + 0,2 (2)	15,85±0,76	3,199±0,14	3,96±0,21
TE 0,4 (1)	22,33±0,82	3,73±0,18	5,56±0,23
TE 0,4 (2)	17,47±0,78	3,22±0,15	4,71±0,22
TE 0,6 (1)	18,89±0,87	2,53±0,13	4,92±0,20
TE 0,6 (2)	17,87±0,9	3,05±0,16	4,46±0,22

*Note: * - treatment: 1 – 05.25.13, 2 – 5.30.13, TE - Trinexapac-ethyl.*

TE in the medium doses increases the photosynthetic activity of leaves, and as the result – improve the efficiency of organic synthesis.

Detection of changes in the content of free basic inorganic anions indicates that the amount of chlorides decreases in all treatment variants up to 30% compared with the control, as well as nitrate – 14%. Orthophosphate content increases considerably with the processing of TE 0.4 and 0.6 l/ha, but for the division dose of the content is reduced 1.5 times. The content of sulfates in the TE leaves the processing is reduced by 15-20% (Table 2).

Table 2

Contents of the main free inorganic anions in flag leaves of wheat variety Zimoyarka

Variants	Chloride, g/kg	Nitrate, g/kg	Orthophosphate, g/kg	Sulphate, g/kg
Control	4,24±0,21	5,6±0,28	3,57±0,18	4,57±0,23
TE 0,4 л/га (1)	4,45±0,22	5,34±0,26	3,35±0,17	3,05±0,15
TE 0,4 л/га (2)	4,93±0,25	2,23±0,11	4,69±0,23	2,72±0,14
TE 0,6 л/га (1)	1,35±0,07	3,37±0,17	2,25±0,11	0,82±0,04
TE 0,6 л/га (2)	2,88±0,14	2,84±0,14	5,46±0,27	3,77±0,19
TE 0,4 + 0,2 л/га (1)	2,98±0,15	1,28±0,06	2,3±0,11	1,17±0,06
TE 0,4 + 0,2 л/га (2)	2,03±0,1	0,78±0,03	2,03±0,1	1,55±0,08

*Note: * - treatment: 1 – 05.25.13, 2 – 5.30.13, TE - Trinexapac-ethyl.*

As we have seen a tendency to reduce total anion content in leaf tissue, it can be assumed that these elements are actively included to the composition of the organic molecules and therefore the ion pool decreases rapidly. This is confirmed by the increased levels of pigments including chlorophyll *a*. Reduced the pool anions can also be caused modulation activity transporters above anions. It is known that their activity is controlled by two factors: content themselves anions of feedback and near hormone molecules that are part of the signaling pathways of gibberellin and auxin [1, 6-9]. Their capacity decreases as the fall of phytohormones content in tissues, as slowing the growth of cells and reduce the need for building material.

Conclusions. Trinexapac-ethyl increases the amount of chlorophyll *a* in the flag-leaf of wheat. Also observed decrease in the content of inorganic anions in the free form, which may indicate the activation of metabolic processes of synthesis of organic matter in the application of derivative cyclohexanedione – trinexapac-ethyl.

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Анотація

Вірич П.А., Ведмеденко Г.Й., Швартау В.В.

Вплив тринексапак-етилу на пігментний і аніонний склад прапорцевих листків пшениці (Triticum aestivum L.)

Було показано, що тринексапак-этил (ТЕ) сприяє збільшенню вмісту хлорофілу а в прапорцевих листках пшениці, сприяючи підвищенню інтенсивності фотосинтезу. Спостерігається зменшення пулу основних неорганічних аніонів, що можливо є свідченням їх активного засвоєння клітинами листка.

Ключові слова: *пшениця, тринексапак-етил, хлорофіл, аніони*

Аннотация

Вирыч П.А., Ведмеденко Г.Й., Швартау В.В.

Влияние тринексапак-этила на содержание пигментов и анионов в листьях пшеницы (Triticum aestivum L.)

Показано, что производное класса циклогександионов тринексапак-этил (ТЕ) способствует увеличению содержания хлорофилла а во флаговых листьях пшеницы, способствуя повышению интенсивности фотосинтеза. Наблюдается уменьшение пула свободных форм основных неорганических анионов, что возможно является свидетельством их активного усвоения клетками листа.

Ключевые слова: *пшеница, тринексапак-этил, хлорофилл, анионы*