

**INFLUENCE FERTILIZERS AND RETARDANT PROTECTION ON  
DYNAMICS CHLOROPHYLL CONTENT IN LEAVES OF SPRING  
BARLEY**

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**Abstract.** *Deals with the results of studies on the effects of fertilization and regulations retardant crop protection in chlorophyll content in leaves of spring barley malting and its impact on productivity of culture. It was established that the investigated elements of growing technology greatly influence the biosynthesis of chlorophyll studied varieties of spring barley. Found a close correlation between chlorophyll content and yield of spring barley malting.*

**Keywords:** *Malting barley, varieties, fertilization norms, retardants, chlorophyll content, yield*

It is well known that the yield of any crop is determined by the intensity of photosynthesis – the process of converting solar energy into chemical bonds of organic matter by using green pigment of plants – chlorophyll. Photosynthetic activity of plants depends on the range of external and internal factors [4]. Internal factors caused by genetic potential of plants, and is the main external light, temperature, moisture providing, concentration in the air of carbon dioxide, soil fertility [2]. In the process of photosynthesis can greatly affect agronomic measures such as fertilization and retardant crop protection [1, 3].

One of the responses of plants to the effect of fertilizers and use of drugs retardantn action is the intensity of photosynthesis, which is largely determined by the content of chlorophyll in the leaves. Therefore, the concentration of pigment per unit mass is an important physiological parameters and can serve as an indicator of availability of crop nutrients [5].

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**The aim of research** was to study the influence of norms fertilization and retardant crop protection the dynamics of chlorophyll a and b in the leaves of plants of spring barley and its impact on productivity of this crop.

**Materials and methods research.** Field research was conducted during 2012–2014 y. In the fields of crop in the department of agronomy experimental station of the National university of life and environmental sciences of Ukraine, in the v. Pshenychne, Kyiv region. The subject of the research were varieties of spring malting barley Vodogray, Hladis, Kangu, Comandor, Konserto and Svyatohor, which recommended for forest-steppe zone. Soil research area – a typical black soil humus. Humus horizon – 55 cm, humus-transition – 60 cm. Agrochemical characteristics of arable layer of soil is: humus (in Turin) – 4,40–4,50 %, total nitrogen contained 0,29–0,34 %, phosphorus – 0,18–0,27 %, potassium – 2,4–2,7 %. The content of mobile phosphorus by Chirikov is 4,6–5,8, exchangeable potassium – 9,6–10,8 mg per 100 g of soil, acidity – pH=6,96–7,20. Area of elementary section – 66 m<sup>2</sup>; accounting area – 36 m<sup>2</sup>. Repeated experiment is 4 single.

General agriculture cultivation in culture experiment is common for Right-Bank forest steppes of Ukraine. The sowing was carried out by seeder Klen-1.5 conventional string method of planting width of 15 cm, depth earnings seeds 3–5 cm. Immediately after sowing field using ring-spurs rinks for an optimal seed placement. Care of crops consisted of a pre-emergence herbicide application and harrowing Dialen Super 464 SL – 0,7 l/ha. In the beginning phase of the output tube plants (phase two units – the disclosure last leaf sinus) made preparations retardant action in accordance with the scheme of the experiment. It was used the following retardants: Hlormekvat chloride 750 (a form of the drug – a. s., The active substance – hlormekvat chloride 750 g/l, the consumption rate – 2.0 l / ha); Terpal (form of the drug – l. c., The active ingredients – mepikvat chloride 305 g/l and etefon 155 g/l, the consumption rate - 2,5 l/ha). In the experiment used the following types of fertilizers: ammonium nitrate (N 64 %); superphosphate (P 20 %) and potassium chloride (K 60 %) who made according to the scheme of

the experiment (table. 1) during pre-sowing cultivation. Yields were determined by continuous during harvesting combine Sampo 250. In studies used the methods which adopted in state testing agriculture crops. Variation-statistical analysis of the results was performed by analysis of variance for B. A. Dospheov, using computer programs («Excel 2010» and «Statistica 6»). The scheme of the experiment is given in table 1.

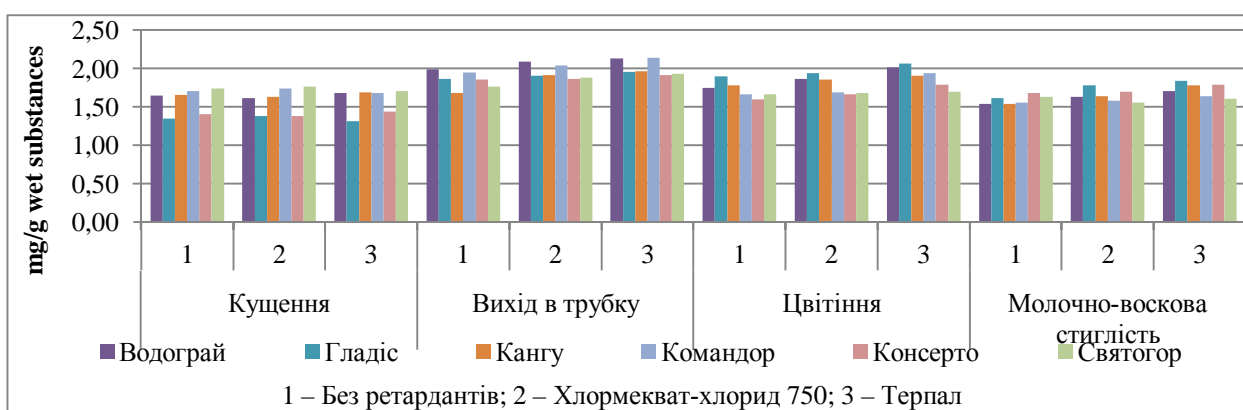
### 1. The scheme of the experiment

Factor A – plant variety	Factor B – retardant protection	Factor C – Rule fertilizer kg a.s. / ha
1) Vodogray (control) 2) Hladis 3) Kangu 4) Comandor 5) Konserto 6) Svyatohor	1) Without retardants (control) 2) Hlormekvat-chloride 750 3) Terpal	1) Without fertilizer (control) 2) N <sub>60</sub> P <sub>60</sub> K <sub>80</sub> 3) N <sub>90</sub> P <sub>90</sub> K <sub>120</sub>

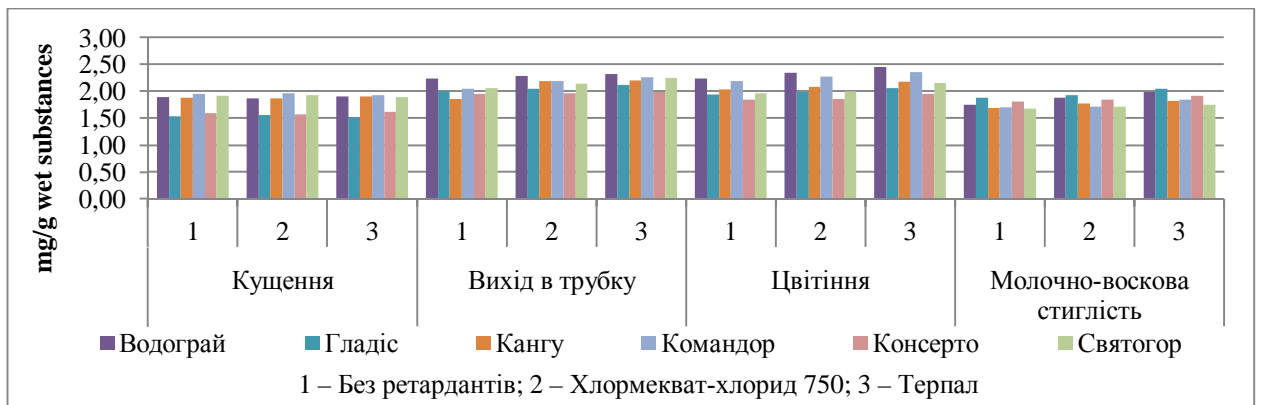
**The results of research.** Established, that the application of different rules fertilizers and retardant protection differently influenced by the content of pigments in leaves of spring barley. The highest concentration of pigments in the studied varieties of spring barley were registered during the phase of earing – flowering. Total content of chlorophyll (a+b) varied within 1,75–2,74 in grade Vodogray, in Hladis 1,87–2,63, 1,68–2,57 in Kangu, 1,67–2,70 in Comandor, 1,60–2,55 in Konserto and 1,67–2,25 mg/g wet weight in grade Svyatohor depending on the norms of fertilizers and retardant crop protection. This indicates that during this period of ontogenesis rate of formation of organic matter is highest. In process of growth and development of plants of spring barley, the intensity of chlorophyll biosynthesis decreased mainly due to the decrease of chlorophyll a. Thus, in the phase of milk ripeness, total chlorophyll content in barley plants was – in a variety of 1,54–1,99 for Vodogray, in Hladis 1,62–2,34, 1,54–2,08 in Kangu, 1,56–2 12 in Comandor, 1,68–2,34 in Konserto and 1,63–2,06 mg/g wet weight in grade Svyatohir, that 0,18–0,52 mg less than in the previous phase of development.

Reduction of chlorophyll in plants in the final stages of ontogeny are inevitable because there is a loss of water chloroplast stroma, collapse them into pellets and as a result – a complete collapse.

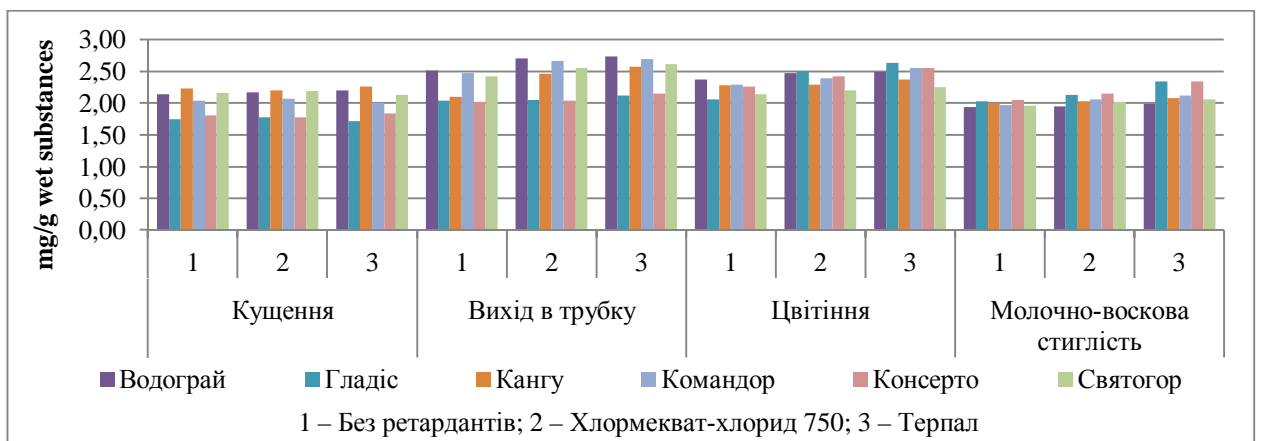
During the phase output of the tube – heading chlorophyll content in plants, compared to the previous period of ontogenesis (tillering) increased: in grade Vodogray – 22,7; in Hladis – 30,3; in Kangu – 9,5; in Comandor – 19,7; in Konserto – by 22,9 and 12,5 % – in a variety of Svyatohor an average of fertilization rules and variants of retardant protection. In embodiments without fertilization higher chlorophyll content in plants investigated barley varieties was observed in variants with processing crops preparations Hlormekvat-chloride 750 and Terpal. In fertilized variants most significant increase in its content compared with the control (no fertilizer) was observed in variants with processing crops Terpal preparation for fertilization in norm  $N_{90}P_{90}K_{120}$ . The content of chlorophyll (a+b) under these conditions varied depending on the variety within 2,12–2,74 mg/g wet substances (figures 1–3).



**Fig. 1 Dynamics of chlorophyll (a+b) in leaves of spring barley depending on retardant protection without the use of chemical fertilizers, mg/g wet substances (average 2012–2014 y.)**



**Fig. 2 Dynamics of chlorophyll (a+b) in leaves of spring barley depending on fertilization in norm  $N_{60}P_{60}K_{80}$  and retardant protection mg/g wet substances (average 2012–2014 y.)**



**Fig. 3 Dynamics of chlorophyll (a+b) in leaves of spring barley depending on fertilization in norm  $N_{90}P_{90}K_{120}$  and retardant protection mg/g wet substances (average 2012–2014 y.)**

During flowering – milk ripeness culture chlorophyll content in plants tended to decrease. The amplitude of the fluctuations on variations of the experiment ranged 1,54–2,34 mg/g wet substances. The minimum value was recorded in the control variant (without fertilizers and retardants), maximum – on versions with normal fertilization  $N_{90}P_{90}K_{120}$  and from use Terpal – preparation with retardant action (figures 1–3).

It was also found that the chlorophyll content in leaves of barley largely determined retardant protection of crops. For example, processing of crops by Terpal, its content increased by 8,7 % in Vodogray variety, 6,5 % in Hladis,

10,5 % in Kangu, 7,4 % in Comandor, 6,0 % in Konserto on and 4,3 % in Svyatohor in the average on phases of growth and development.

The calculations revealed that chlorophyll content in plants spring barley during the growing season significantly affect its yield (multiple correlation coefficient  $r=0,90$ ).

So, the results of our studies, we can conclude that improving nutrition conditions of spring barley by fertilization and normal  $N_{60}P_{60}K_{80}$  and  $N_{90}P_{90}K_{120}$  and for processing crops retardants in terms of Right-Bank Forest Steppe of Ukraine are the most effective means of increasing the biosynthesis of chlorophyll in leaves of culture, that turn positively affects its productivity.

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## **ВПЛИВ УДОБРЕННЯ ТА РЕТАРДАНТНОГО ЗАХИСТУ НА ДИНАМІКУ ВМІСТУ ХЛОРОФІЛУ В ЛИСТКАХ ЯЧМЕНЮ ЯРОГО**

**С. М. Каленська, Б. Ю. Токар**

*Анотація.* Висвітлені результати досліджень з питань впливу норм удобрення та ретардантного захисту посівів на вміст хлорофілу у листках ячменю ярогопивоварного та його впливу на урожайність культури. Встановлено, що досліджувані елементи технології вирощування значною мірою впливають на біосинтез хлорофілу досліджуваних сортів ячменю ярого. Встановлено тісний кореляційний зв'язок між вмістом хлорофілу і врожайністю ячменю ярого пивоварного.

**Ключові слова:** ячмінь ярий пивоварний, сорти, норми удобрення, ретарданти, вміст хлорофілу, урожайність

## **ВЛИЯНИЕ УДОБРЕНИЯ И РЕТАРДАНТНОЙ ЗАЩИТЫ НА ДИНАМИКУ СОДЕРЖАНИЯ ХЛОРОФИЛЛА В ЛИСТЬЯХ ЯЧМЕНЯ ЯРОВОГО**

**С. М. Каленская, Б. Ю. Токар**

*Анотация.* Представлены результаты исследований по вопросам влияния норм минеральных удобрений и ретардантной защиты посевов ячменя ярового на содержание хлорофилла в листьях и его влияния на урожайность культуры. Установлено, что исследуемые элементы технологии выращивания в значительной степени влияют на биосинтез хлорофилла исследуемых сортов ячменя ярового. Установлена тесная корреляционная связь между содержанием хлорофилла и урожайностью ячменя ярового пивоваренного.

**Ключевые слова:** ячмень пивоваренный, сорта, нормы удобрения, ретарданты, содержание хлорофилла, урожайность