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PHOTOSYNTHESIS PIGMENTS CONTENT IN DURUMSPRING WHEAT LEAVES DEPENDING UPON THE ACTION OF CROPS UREA ADDITIONAL FERTILIZING AND MICRO FERTILIZERS

A. O. Rozhkov, Candidate of Agricultural Sciences
Kharkiv National Agrarian University named after V. V. Dokuchayev

The results of the three-year researches (2008 – 2010) concerning the dynamics definition of the photosynthesis pigments formation in durum spring wheat variety Kharkivs’ka 41 while using urea additional fertilizing and micronutrient elements are given. The significant influence of the researched factor on chlorophylls and carotenoids content in the plants leaves is determined. The advantage of the complex use of urea (N_m 30kg/ha) and Crystalon on the chlorophylls and carotenoids content increase in the plants leaves is defined. There is the direct correlation between the content of pigments in plants leaves, the index of leaf surface and grain productivity.

Spring wheat, chlorophyll a and b, carotenoids, regression, correlation, micro elements, pigments, phenophases, leaf surface index.

The most important function of plants is the formation of organic substances in the process of photosynthesis. The necessary condition for passing photosynthesis is the presence of chlorophyll pigments in plant cells [1,2]. Pigments are acceptors that absorb photons of the visible part ofthe solar spectrum and are involved in the conversion of light energy into the energy of chemical bonds.

The researches of the chlorophyll accumulation dynamics in the leaves of plants arevery important because its content affects the intensity of photosynthesis and some other physiological processes.

Literature review on the researched topic. The content of chlorophyll *a* and *b*in plants leaves is on average about 0,3% of wet weight, varying in the range from 0,1 to 0,7% [3].

The researches of additional fertilizing influence on wheat crops showed the presence of certain changes in the number of basic forms of pigments [4-6].

The number of pigments in plants is determined primarily by genotypic peculiaritiesand within the normal genotype reaction by conditions of its cultivation [7, 8]. That is why the researches, which are aimed at studying pigments accumulation, the features of the leaf pigment apparatus formation in the ontogenesis,

are of particular importance in the evaluation of the influenceof growing technology elements on crops productivity.

Taking into consideration a great amount of micro elements in the black soil (chernozem), the most part of them remained unavailable for absorption. The effectiveness of application of micronutrients with classical chemical fertilizers is also too low, since microelement compounds quickly connect with soil absorbing complex and are unavailable or inaccessible for plants. In this regard, for full plants use of microelements it is more appropriate to applywater solutions of microelementscompounds on the aboveground and floral parts of plants [9,10]. For this application method it is more appropriate to apply chelated chemical compounds that include a wide range of microelements whose absorptionlevel of green plant tissue from water solutions is about 85%.

The purpose of the researches was to establish the influence of different fertilizing variantsof durum spring wheat variety Kharkivs'ka 41 by urea and microelements on the dynamics of photosynthesis pigments accumulation in the plants leaves as their content affects the intensity of photosynthesis and some other physiological processes.

Methods of the researches. The researches of the influence of urea and micronutrient fertilizing Crystalonon the photosynthesis pigmentscontent in the plants leaves of durum spring wheat variety Kharkivs'ka 41 were conducted during 2008 – 2010 based on the base of eight-field vapour grain row crop rotation of Plant Growing chair of KhNAU named after V.V. Dokuchayevusing the conventional method [11].

Such variants of foliar crops additional fertilizingwere applied in the researches: 1 – control (cropwatertreatment); 2 – Crystalon; 3 – Nm20 kg/ha; 4 – N_m30 kg/ha; 5 – N_m40 kg/ha; 6 – N_m20 kg/ha + Crystalon; 7 – N_m30 + Crystalon; 8 – N_m40 + Crystalon. Micronutrient Crystalon special was used according to the recommended dosage of about 1,5 liters/ha in water solution. The repeatability of the researchwas three times, the sown area – 30m^2, accounting – 20 m^2. All the elements of the technology except the studied element weregenerally accepted for this area of researches – Eastern Steppe of Ukraine.

The soil of the experimental field is typical black soil (chernozem)heavy loamy on carbonate loess. In the arable soil layer contains 4,4 – 4,7% of humus, 13,8mg of mobile phosphorus and 10,3mg of potassium per 100g of soil.

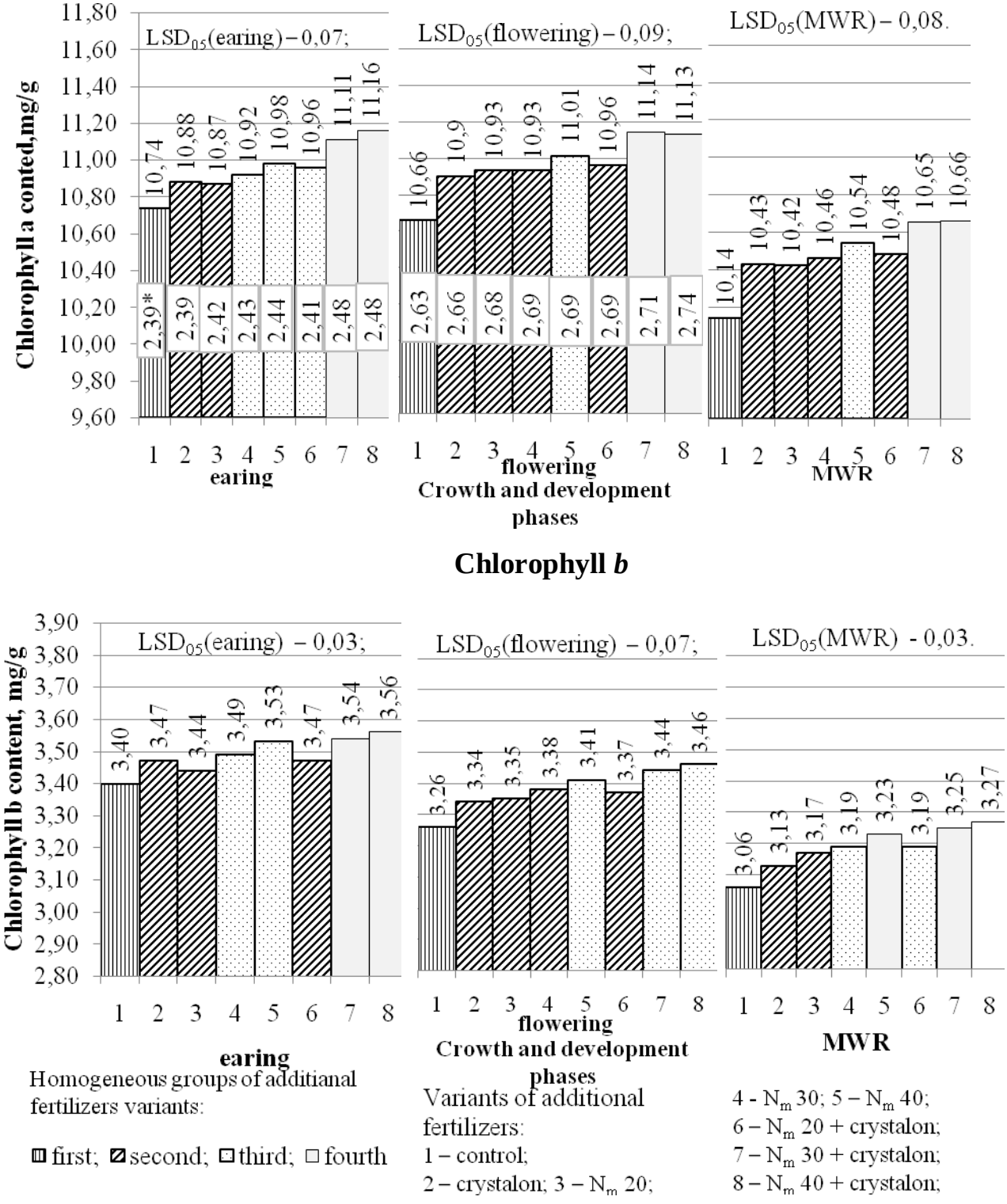
The place of the researches has a character of unstable moistening. The rate of precipitations during the growing season of durum spring wheat (March – July) was 314,1mm in 2008, 243,9mm in 2009 and 218,7mm in 2010 at the average long-term index– 241,0 mm. The most favourable growing year was 2008 according to the amount of precipitations and their distribution.

The temperature conditions during the growing periods of the researchesdiffered from the average long-term indices. The established excess temperatures brought significant correctives in the growth and development of plants, their grain productivityformation. A significant divergenceat the main meteorological parameters during the years of researches has allowed determining the impact of foliar fertilizing on the productivity of the researched indices.

The results of the researches and the discussion. The positive impact from fertilizers applicationon chlorophyll*a* and *b*content compared with the control was installed in all the variants of the researches. The difference in chlorophyll *a* content in plants leaves between the lowestproductivevariantof fertilizing and the control on average for three years of researches was 0,14 mg/g in the phase of earing; 0,24 mg/g in the phase of flowering and 0,29 mg/g in the phase of milk wax ripeness (MWR) at the lowest significant difference – LSD_{05}: 0,07, 0,09 and 0,08mg/gappropriately (Picture 1). Chlorophyll *b*content compared with the control in the lowestproductivevariantof fertilizing appropriatelyto the mentioned phases of development was 0.04 mg/g, 0,08 mg/g and 0,07mg/g higher at the lowest significant difference – LSD_{05}: 0,03, 0,07 and 0,03 mg/gaccordingly.

It should be noted that the use of urea fertilizer and Crystalon (N_{20}kg/ha a.s.) on average over the three years of researches did not provide a significant increase in the content of carotenoids in the leaves of plants.

Chlorophyll *a*



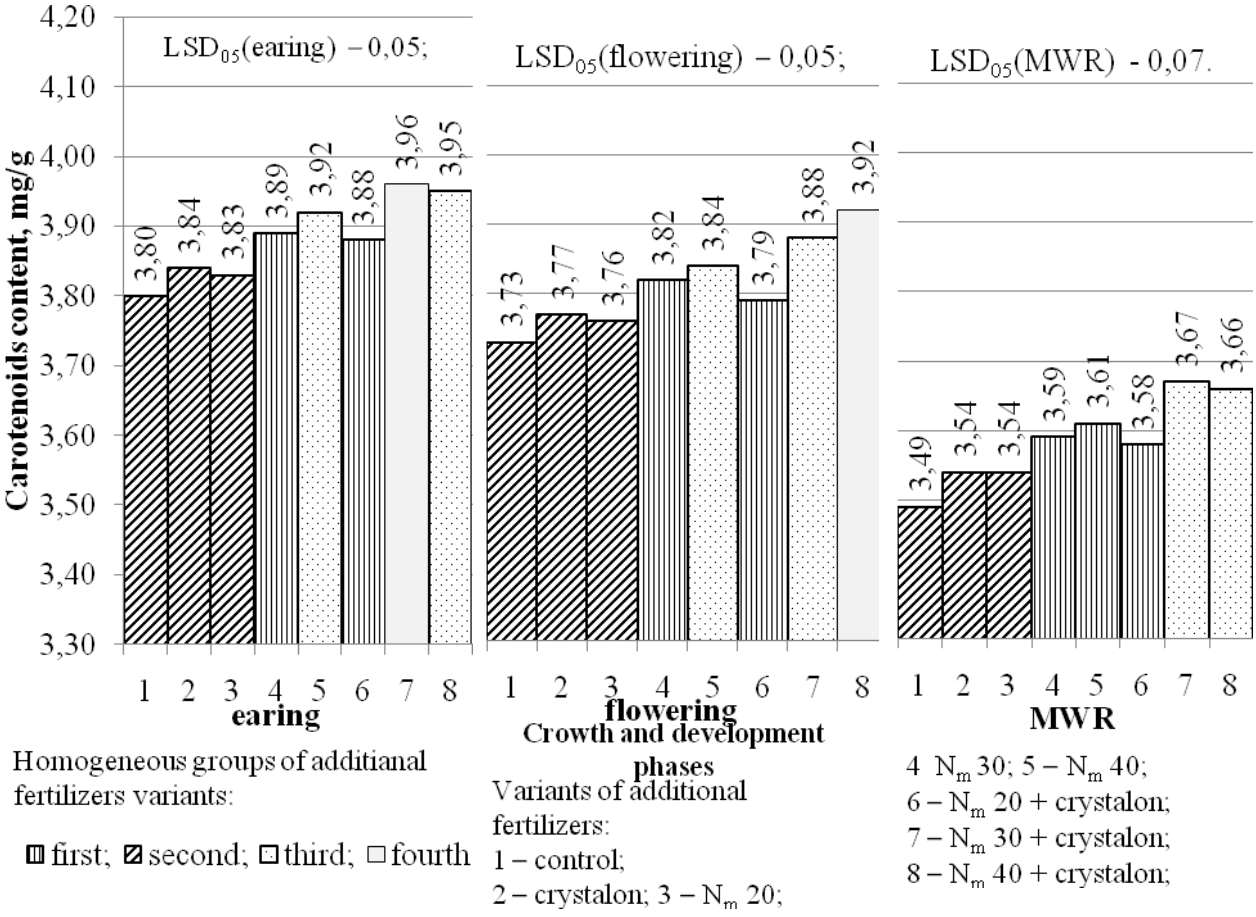
Picture 1. Chlorophylls content in durum spring wheat leaves depending upon foliar additional fertilizers, mg/g (average for 2008 – 2010)

Carotenoids content indicators in plants leaves of the mentioned variants and the control belonged to one homogeneous group (Picture 2).

The greatest impact on both the chlorophyll *a* and *b* content and the carotenoids content in durum spring wheat leaves at all phases in which the determination had been carried out had the variant of applying of urea foliar

additional fertilizing (N_m30 kg/ha) with Crystalon in the recommended application dosage. Further dose increasing of urea to 40 kg/haof nitrogen did not provide a substantial increase of photosynthesis pigments content in theplants leaf mass.

The close direct correlation between total chlorophylls content and leaf surface index (r = 0,948) was determined in the researches. The dependence is approximated by a linear regression equation: y = –2,17455 + 6,21489x which acts within the researched variants in 89,8% of cases (r^2= 0,898).



Picture2.Carotenoids content in durum spring wheat leaves depending upon the foliar fertilizing, mg/g (average for 2008 - 2010)

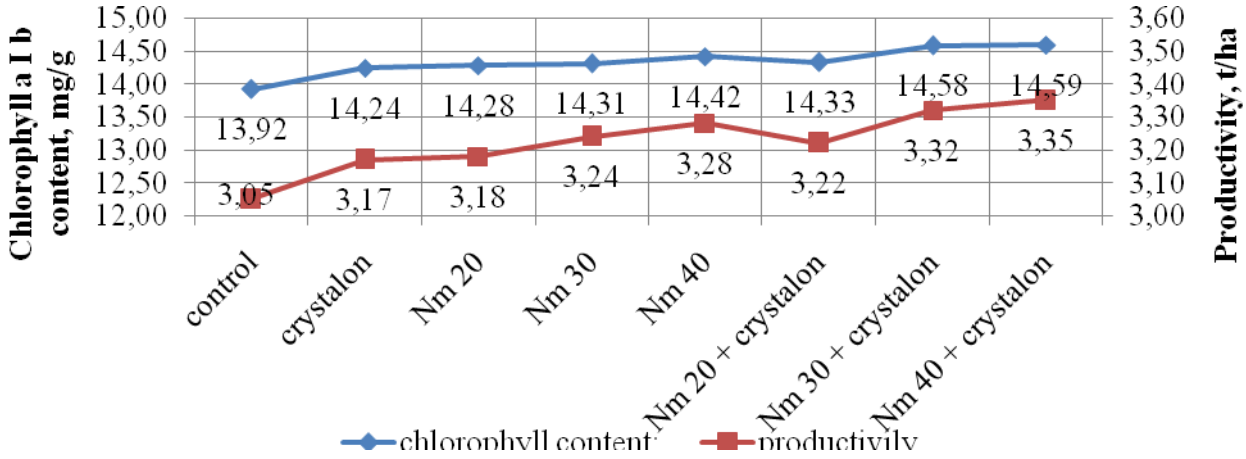
There is also the close direct correlation (r = 0,927) between carotenoids content and the leaf surface index. It is also approximated by the equation of linear regression: y = – 1,044481 + 1,82910x which acts within the researched variants in 85,9% of cases (r^2 = 0,859).

Maximum photosynthesis pigments content in durum spring wheat leaves on average forthe three years of researches reached during the phase of earing. The established correlation is coordinated with previousresearches [12, 13].

A more significant reduction of all groups of pigments from the phase of earing to the phase of flowering and MWR was on controlledvariants – without fertilizing due to the fact that the use of the trophic factor provides more durable proper functioning of photosynthesis physiological processes. This tendency in general agrees and confirms the researches of Yu. P. Fedulov and Yu. V. Podushyn [5].

The reduction of photosynthesis pigments in durum spring wheat from the flowering phase is a natural process because there is a loss of water by chloroplast stroma, theirdisintegration into granules, resulting in the destruction of chloroplasts.

The highest grain productivityon average over the three years of researches was in variants that provided the highest photosynthesis pigments content in plants leaves(Picture 3).



Picture 3. The dynamics of chlorophyll *a* and *b* content in the phase of flowering and durum spring wheat productivity depending upon the action of the trophic factor (average for 2008 - 2010)

In the conducted researchesthe strong direct correlation between total chlorophylls content during the phase of flowering and durum spring wheat productivity has been established (r = 0,984). This dependence is approximated by the following linear regression equation: a = – 3,09190 + 0,44079x which acts within the researched variants in 96,8% of cases (r^2 = 0,968).

During the researchesthe regularity in increase of correlation between the amount of chlorophylls and carotenoids in theplants development had been established –from the phase of earing to the MWR which was due to the earlier

destruction of carotenoids which reached their maximum concentration before chlorophyll *a* and *b*.

Conclusions. Application of additional fertilizers on durum spring wheat provided a significantincreasein photosynthesis pigments content indices in plants leaves.The best variant of additional fertilizing on durum spring wheat crops was the variant of applying the complex urea fertilization at the rate of 30 kg/ha with micronutrient Crystalon.Nitrogen dosesincreasing to 40 kg/ha did not provide a significant increase of photosynthesis pigments in the leaves of plants. The direct strong correlation between pigments content in the leaves and durum spring wheat crops productivity was proved during the researches.