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CONTENT AND RATIO OF PLASTYD GREEN PIGMENTS IN SUGAR SORGHUM LEAVES DEPENDING ON NUTRITION AND HERBICIDES CORRELATION EFFECTS

Given are the results of experiment on the content of a and b chlorophyll and their amount in sorghum sugar leaves (Silage-42 variety) depending on the usage of different mineral fertilizer rates as well as weed control chemical methods. Revealed is that combine effect of fertilizers and herbicides increases chlorophyll content in sorghum plant leaves.

Keywords: *sorghum; variety; fertilizer rate; herbicides; chlorophyll.*

Introduction. Chlorophyll is an element of plant leaf cell and performs a vital function for the plant organism, namely: the synthesis of organic matter from inorganic compounds of CO₂ and H₂O in the absorption of radiation energy of light.

The concentration and total amount of chlorophyll in plant leaves is an important physiological parameter. This parameter describes the potential capacity of the photosynthetic apparatus in various stages of growth, plant response to the effect of various factors (mineral nutrition, plant chemical protection from weeds, natural environmental factors etc.) and has a close relationship with plant organism productivity.

According to scientific sources [1] C₄ photosynthesis plants (maize, sorghum, millet) have high rates of photosynthesis intensity and are characterized by high yield. Photosynthesis intensity depends on the factors, for which weeds compete with cultivated plants (heat, moisture, nutrients), and from which the yield is depended. Herbicides, while reducing the amount of weeds, contribute to better plant supply with abiotic factors. The level of chlorophyll may depend on the efficiency of crops protection from weeds [2].

The aim of our experiment was to investigate the content of a and b chlorophyll in sugar sorghum leave as the main photosynthetic plant organ, to determine dependency of green pigment content from nutrition, as well as to investigate the effect of chemical methods of weed control on photosynthetic pigment formation in sugar sorghum leaves.

Materials and methods. Field experiments were carried out in 2011-2013 in the fields Uladovo-Liulynets EBS of Institute of Bioenergy Crops and Sugar Beet NAAS.

Soil of the experiment plots was deep poor humus chernozem. The cultivated layer consisted 3.7% of humus, 10.3% of light hydrolyzed nitrogen, as well as 23.3 and 13.5 mg of phosphorus and potassium mobile forms per 100 g of soil, respectively; pH of soil solution 5.6; hydrolytic acidity was 1.5 meq/100 g of oil.

To achieve the goal, our experiments were performed with Silage-42 sugar sorghum in respect of a number of factors that can affect significantly the chlorophyll content, namely: the effect from different fertilizer rates (control (without fertilizers), N₈₀P₈₀K₈₀, N₁₆₀P₁₆₀K₁₆₀) and the effect of herbicides.

The experiment was carried out by systematic repetition method. The experiment variants in each repetition were placed in the plots consistently. The experiment was replicated three times. Sowing was carried out to a depth of 5 cm, the row space width was 30 cm with 300000 seeds per a hectare. Mineral fertilizers (ammonium nitrate, granular superphosphate and potassium chloride) were scattered for ploughing under the experiment scheme. Spraying was made by OP-2000 boom sprayer with DialenSuper herbicide solution in the phase of 3-5 crop leaves at fertilizing rate of 1.0-1.25 l/ha and with working liquid usage rate of 220-250 l/ha. Spraying was carried out in the sunny dry weather at temperature between 16 and 24 °C.

Determining plastid green pigments in sugar sorghum leaves was performed by spectrophotometric analysis [3, 4] with simultaneous definition of dry matter content in leaf plates. Concentration of *a* and *b* chlorophylls and their amount were calculated in milligramme per a gramme of dry matter.

Results. The experiment results manifested that the essential for chlorophyll formation is fertilizer rates as well as chemical methods of weed control (Fig. 1-3).

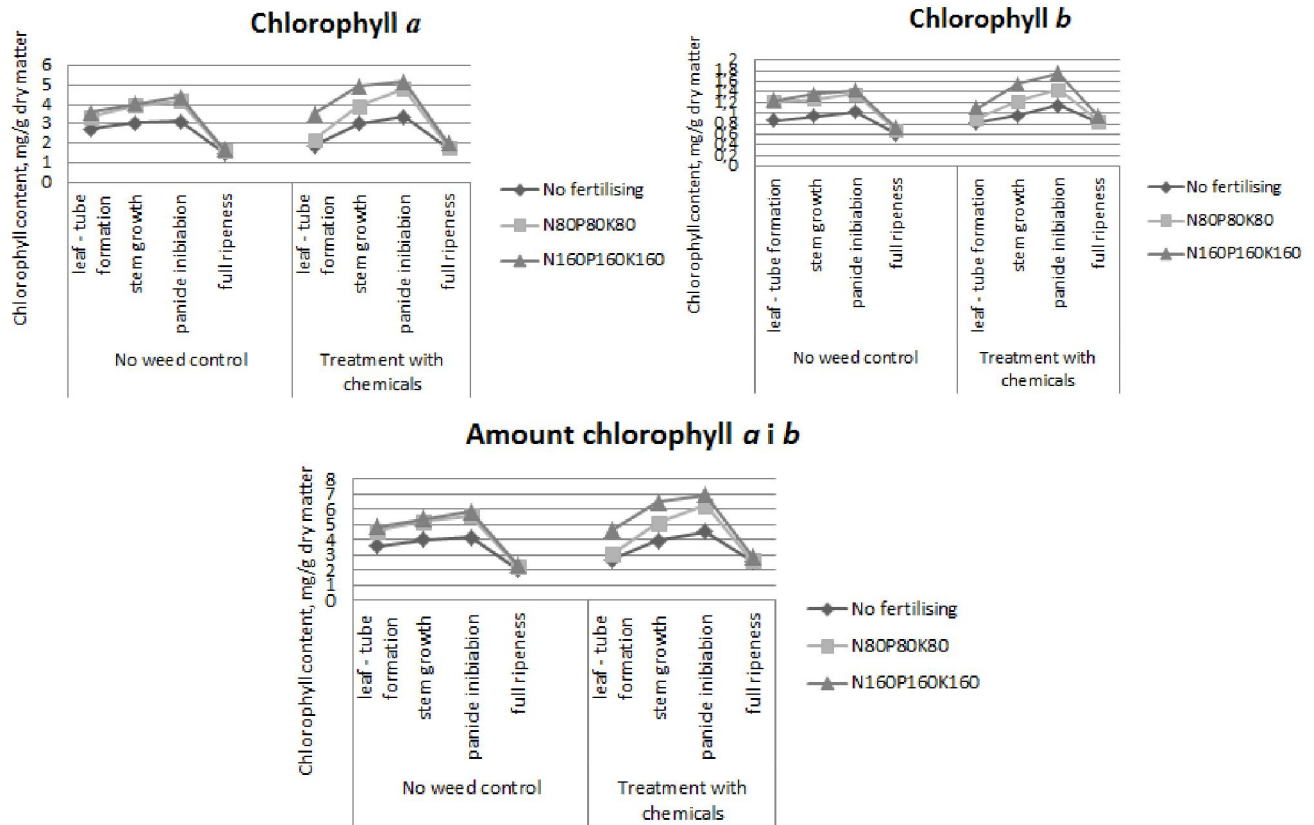


Fig.1-3. Chlorophyll contents in sugar sorghum plants depending on nutrition and herbicides (mg/g of dry matter), average for 2011-2013

With fertilizer applying in the rate of $N_{80}P_{80}K_{80}$ *a* chlorophyll content in the panicle ejection phase in variants with chemical cultivation, compared with the weed control plots, increased by 14.8%, *b* chlorophyll content increased by 6.7%, as for fertilizer applying in the rate of $N_{160}P_{160}K_{160}$ the increase was 18.2% and 22.4%, respectively.

Although the issue of mineral effect on chlorophyll changes in ontogenesis of different crops is still far from complete solution, it just proved that fertilizers contribute to chlorophyll productivity at higher and sustainable level [5].

Fertilizers have a significant effect on *a* and *b* chlorophyll contents in the early growth stages. Sugar sorghum plants, which grew at high agrobacground, distinguished by high chlorophyll content compared with other variants throughout the entire growing season.

According to observations of some researchers [6, 7] the amount of plant chlorophyll increases with plant age and quickly reaches the level of adult plants. This rate is predetermined by plant hereditary characteristics and depends on lighting conditions, nutrition and other factors.

Chlorophyll content in sugar sorghum at the beginning of the growing season was in average for weed control variant 4.35 mg/g and for chemical cultivation variant 3.48 mg/g of dry matter. After transition from the stem growth phase to the panicle initiation phase chlorophyll content in all experiment variants reached maximum rates and remained on high level for long time of growing (4.17 - 5.82 mg/g of dry matter for control variant and 4.53-6.94 mg/g for variants with herbicides). This can be explained by the fact that protoplast livelihood increased by improving of plant

nutrition, also we have observed the growth of their hotbeds and hence increasing in size of plastid-containing cells as well as formation of new cells, which resulted chloroplast increasing in the cell. After the panicle initiation phase chlorophyll content in sugar sorghum leaves began to decrease to 2.08 – 2.41 mg/g of dry matter in the weed control plots and to 2.59 – 2.74 mg/g for variants with chemical cultivation that was a result of leaves growth and formation process termination as well as the beginning of their aging.

The findings revealed importance of minerals in biosynthesis and stabilization of chlorophylls. This is the evidence that in order to maintain chlorophyll content at high level the plant needs of fertilizers in sufficient quantity during the entire growing season.

Higher efficiency of weed control in the chemical cultivation plots conducted of increasing in plant chlorophyll content for the cultivated plant variants. It was revealed that the usage of pastemergences produced some suppression of sugar sorghum plant growth that is indicated by difference in number of chlorophylls in stem formation phase, which was 28.8% compared with the control variants. However, it should be noted that even in the panicle initiation phase chlorophyll content in leaves of sugar sorghum manifested in favour of variants using herbicides.

The highest chlorophyll content in sugar sorghum plants was in herbicide N₁₆₀P₁₆₀K₁₆₀ variants.

Conclusions. Research of *a* and *b* chlorophylls content and their amount in Silage-42 sugar sorghum, depending on mineral nutrition background and crop protection from weeds, manifested that the combined effect of fertilizers and herbicides leads to increased chlorophyll content in leaves of sorghum plants by 15.1% against the background of average fertilizer rate, and by 22.4% when using full fertilizer rate.

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Анотація

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Вміст та співвідношення пластидних зелених пігментів у листках рослин сорго цукрового залежно від впливу елементів живлення та гербіцидів

Наведено результати досліджень з вивчення вмісту хлорофілів *a*, *b* та їх суми в листках рослин сорго цукрового (сорт Силосне 42) залежно від застосування різних доз мінеральних добрив та хімічних методів боротьби з бур'янами. Встановлено, що сумісна дія добрив та гербіцидів призводить до підвищення вмісту хлорофілів в листках рослин сорго цукрового.

Ключові слова: сорго цукрове, сорт, дози добрив, гербіциди, хлорофіл

Аннотация

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Содержание и соотношение пластидных зеленых пигментов в листьях растений сорго сахарного зависимо от влияния элементов питания и гербицидов

Приведены результаты исследований по изучению содержания хлорофиллов а, в и их суммы в листьях растений сорго сахарного (сорт Силосное 42) в зависимости от применения различных доз минеральных удобрений и химических методов борьбы с сорняками. Установлено, что совместное действие удобрений и гербицидов приводит к повышению содержания хлорофиллов в листьях растений сорго сахарного.

Ключевые слова: сорго сахарное, сорт, дозы удобрений, гербициды, хлорофилл