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FORMATION OF PHOTOSYNTHETIC PARAMETERS OF CROPS OF DIFFERENT ORIGIN BUCKWHEAT VARIETIES IN THE WESTERN FOREST-STEPPE

This research is dedicated to the influence of microelements on the formation of the photosynthetic parameters of crops of different origin buckwheat varieties in western forest-steppe of Ukraine. The results showed that the use of microelements contributed little to the variability of the studied parameters. More significant was the impact of varietal characteristics of buckwheat and the weather conditions of the growing season. At the same time, the yield of buckwheat treated with microelements has significant increased.

***Keywords**: variety, buckwheat, microelements, leaf surface area, chlorophyll content in leaves, PAR utilization, productivity*

Introduction. Buckwheat honey is valuable cereal and culture, which is of great economic importance. Buckwheat is used for the production of pharmaceutical drugs, food coloring, food processing - to obtain bacterial fertilizers , and more. In addition, it is highly valued as a honey culture [1].

The problem of stable and effective production of sufficient quantities of agricultural products is becoming increasingly important. The lack of productivity occurs because there is no strict adherence to farmers scientifically based technical recommendations of growing crops, especially these are unbalanced mineral nutrition, lack of use of plant protection products of growth stimulating of new generation materials and unfavorable weather conditions during the growing season.

All these factors, according to official figures NAAS of Ukraine, is the reason for the large gap between potential and actual yields of crops.

The inclusion of growing crops technology of growth regulating matters is the need to study the impact of micronutrients on growth and development processes of buckwheat.

Formation of yields is determined by the area of plant assimilation system, its life expectancy and productivity of photosynthesis, the ratio between the processes of assimilation and dissimilation. The study of the process of photosynthesis allows to define the nature of metabolism and explore the possibilities of purposeful management processes of growth and development and ultimate productivity of plants under different conditions of nutrition.

Crop of plants, including buckwheat, is determined by the size and productivity of the photosynthetic apparatus. According to Nychyporovych A.O. well formed photosynthetic apparatus is an important criterion for high performance of modern varieties. It should provide the best work in intensity and quality in all phases of plant growth and development [2].

The level of biological yield determined by the size of the assimilation surface, the intensity of photosynthesis and lifetime of the leaves, the relation between the processes of assimilation and dissimilation. The study of the process of photosynthesis to determine the nature of the metabolism and brings us to one of the main problems of biology - opportunities targeted to manage the growth and development of plants and ultimate performance [3].

Analysis of works, that was conducted by Lahanov A.P., Kolomeychenko V.V. and others and devoted to the study of photosynthetic parameters of buckwheat, revealed the presence of differences of opinion on the issue of the relationship of size assimilating surface of leaves and harvest. Thus, it was set a close correlation between leaf surface area and grain yield in the work of Kalus Y.A. At the same time, Soboleva P.A. though she found a close correlation between leaf area and yield of buckwheat, but notes that the positive relationship between these parameters can not be, because the conditions for vegetative and generative organs are not identical.

There is conclusion of weak dependence on grain productivity of buckwheat leaf surface area contained in other works. The answer to these differences is in the study on the crops of different density, performed by Dzhavaki N., in which it was found that the index leaf surface crops of different densities (25 to 400 pieces of plants per m2) differed a little from each other (2.3 -4.0 m2/m2) [4].

The aim was to identify the peculiarities of the photosynthetic parameters of crops of different varieties of buckwheat in origin based on the use of microelements in the environment of the southern part of the western steppes of Ukraine.

Materials and methods. Field studies were conducted at the experimental field of the Institute of cereals PSATU (2008-2012). Experimental field is located in the southern part of Khmelnitsky region, which belongs to the southern agro-climatic thermal area.

Victoria, Roxolana and Zelenokvitkova 90 varieties were studied.

Method of sowing – wide row and rate of sowing is 2.2 million similar seeds per 1 hectare. Accounting area –is 20 m2. It was repeated four times. Farming equipment in the experiment is common. Seed treatment technology is similar to incrustation. It was used an aqueous solution of microelements to prepare the slurry. Treatment of seed was held for 2-3 days before planting. There were used the following agents at seed processing: zinc - $ZnSO_4$, copper - $CuSO_4$, molybdenum - (NH_4) $2MoO_4$, magnesium - $MgSO_4$, boron - H_3BO_3, iodine - KI.

Accounting, monitoring and analysis of experiments were carried out by conventional methods [5, 6].

Results and discussion. Crop of plants, including buckwheat, is determined by the size and productivity of the photosynthetic apparatus. We can observe a significant fluctuations scales formed by assimilation surface in buckwheat and in other agricultural plants, depending on the genotype and the duration of its growing season, on phytocoenotic relationships, as well as meteorological and environmental growth conditions.

The average area of leaf surface was 44.4 th.m^2/ha during years of studies (Table 1). The largest area of leaf surface was in Zelenokvitkova-90 variety - 47.5 th.m^2/ha and it is driven by varietal characteristics. For factor A (microelement), the biggest growth area of leaf surface was observed in the application of magnesium, molybdenum and copper. An increase of the leaf surface area was very small in the application of boron and zinc. Reduction of leaf surface area was observed in crops of buckwheat in the application of iodine (Table 1).

Chlorophyll plays the main role in photosynthesis. In the process of photosynthesis chlorophylls perform complex functions: light absorption, light transmission, power transmission, transfer of electrons. The total chlorophyll content in plants is 0,6 – 1,2% of dry matter [3].

During ontogeny rate of photosynthesis is constantly changing. Under optimal conditions of water supply of wheat, the maximum content of chlorophyll was observed in leaves at flowering stage. Its content significantly decreased during the drought [7].

Many authors have noted a direct relationship between photosynthesis and chlorophyll content [7-9]. However, there is a perception that direct correlation is observed only in the early stages of ontogeny. With aging plants it was observed a rapid decrease in the intensity of photosynthesis and chlorophyll content in leaves [10]. Data from the scientific literature suggest a complex relationship between chlorophyll and photosynthesis and ultimate productivity of different crops.

Buckwheat is presented very little in these studies. On the basis of studies it is found that microelements affect ambiguous on the amount of chlorophyll in leaves of buckwheat. On average, in the experiment, chlorophyll content in leaves of buckwheat was 1.11 mg / g of wet weight. Molybdenum, copper, magnesium and boron had the best influence on the chlorophyll content among studied microelements. When using zinc and iodine content of chlorophyll in leaves of buckwheat has not significantly changed. Among the varieties Zelenokvitkova -90 had somewhat higher chlorophyll content, which on average was higher than others at 1-3% (Table 1).

According to the theoretical studies of plants productivity limits are determined by the amount of solar energy which they accumulate. The amount of solar radiation that enters the Earth can not be changed, but the amount of energy used by plants can be adjusted over a wide range. This can be achieved by adjusting the light, water, nutrients and air modes of agrocenoses and influence on the intensity of production processes through the complex of technological, agro-chemical, genetic and other factors [3].

Table 1

Formation of photosynthetic parameters of crops of different varieties of buckwheat in origin (average for the years of studies)

Microelement (factor A)	Victoria	Deviations from the control	Roxolana	Deviations from the control	Zelenokvitkova 90	Deviations from the control
Buckwheat leaf surface area of different varieties, thousands m^2/ha						
Control	42,4	-	42,3	-	47,1	-
Zinc $ZnSO_4$	42,5	0,1	42,4	0,1	47,1	-
Copper $CuSO_4$	43,1	0,7	42,9	0,6	47,9	0,8
Magnesium $MgSO_4$	43,3	0,9	43,2	0,9	48,1	1,0
Molybdenum $(NH_4)_2MoO_4$	43,1	0,7	42,9	0,6	47,8	0,7
Boron H_3BO_3	42,6	0,2	42,5	0,2	47,4	0,3
Iodine KI	42,3	-0,1	42,1	-0,2	47,0	-0,1
Average of the factor A	42,8		42,9		47,5	
$LSD_{0,05}$ (A)= 0,55; $HIP_{0,05}$ (B) = 0,56; $LSD_{0,05}$ (AB) = 0,95						
Chlorophyll in the leaves of plants of different varieties of buckwheat, mg/g wet weight						
Control	1,07		1,08		1,13	
Zinc $ZnSO_4$	1,08	0,01	1,09	0,01	1,14	0,01
Copper $CuSO_4$	1,10	0,03	1,11	0,03	1,16	0,03
Magnesium $MgSO_4$	1,11	0,04	1,12	0,04	1,17	0,04
Molybdenum $(NH_4)_2MoO_4$	1,10	0,03	1,11	0,03	1,16	0,03
Boron H_3BO_3	1,10	0,03	1,10	0,02	1,15	0,02
Iodine KI	1,08	0,01	1,09	0,01	1,13	-
Average of the factor A	1,09		1,10		1,15	
$LSD_{0,05}$(A)= 0,01; $HIP_{0,05}$ (B) = 0,01; $LSD_{0,05}$ (AB) = 0,02						

One of the main tasks of crop area is increasing the efficiency of solar energy, which reflects the ratio of the amount of energy accumulated in products of photosynthesis or formed in biomass of yield, to the amount of used radiation. The utilization coefficient of PAR is an integral factor of influence of all other factors on the productivity of the crop.

Targeted biological change of the crop through the creation of new varieties is quite a significant factor in this regard. Green floral variety Zelenokvitkova 90 was characterized by the biggest coefficient, in which this indicator was an average of 0.94% (Table 1).

Utilization coefficient of PAR in white floral varieties Victoria and Roxolana was significantly lower than in Zelenokvitkova 90 - 0.86 and 0.91 respectively. This advantage is partly due to the presence of green pigments in flowers that are involved in photosynthesis. A slight variation of PAR utilization coefficient is observed in crops of buckwheat in the application of microelements.

Table 2

Buckwheat productivity of different varieties depending on the microelements, t/ha (average for the years of studies)

Microelement (factor A)	Variety (factor B)					
	Victoria	Deviations from the control	Roxolana	Deviations from the control	Zelenokvitkova 90	Deviations from the control
Control	1,62		1,63		1,55	
Zinc $ZnSO_4$	1,65	0,03	1,66	0,03	1,57	0,02
Copper $CuSO_4$	1,71	0,09	1,73	0,10	1,65	0,10
Magnesium $MgSO_4$	1,69	0,07	1,72	0,09	1,63	0,08
Molybdenum $(NH_4)_2MoO_4$	1,70	0,08	1,72	0,09	1,64	0,09
Boron H_3BO_3	1,71	0,09	1,73	0,10	1,64	0,09
Iodine KI	1,60	-0,02	1,62	-0,01	1,54	-0,01
Average of the factor A	1,67		1,69		1,60	
$LSD_{0,05(A)}$= 0,04; $LSD_{0,05\ (B)}$ = 0,03 ; $LSD_{0,05\ (AB)}$ = 0,07						

Productivity is the main criterion for evaluating the work of plant growers. The basis of this index is the unity of photosynthesis, plant nutrition, morphogenesis and external environmental conditions, which is the life of plants throughout the growing season. Based on the data of yield it is estimated all agronomic measures, taking into account all of the observations and analysis. Many researchers believe that the yield of buckwheat is determined by weather conditions more than other crops. [3] Our data suggest that the effectiveness of different options is primarily dependent on the weather conditions of the growing season.

Varieties that have been studied significantly differed in yield, Roxolana variety was the most productive, the average yield was 1.69 t / ha (Table 2).

For factor A (microelements) boron, copper, magnesium, molybdenum were the most effective minerals, growth yield was 0,07-0,10 t / ha. Negative trend was observed in application of iodine, the average yield decreased by 0,01-0, 20 t / ha (Table 2).

Conclusions. According to the research we can conclude that the use of microelements contributed a small variability in photosynthetic parameters of crops of different varieties of buckwheat in origin, these parameters were more influenced by varietal characteristics. Yield was influenced by microelements more significantly, boron, copper, magnesium and molybdenum were the most effective microelements, negative trend was observed in the application of iodine.

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Анотація

Дорошенко О.Л., Хоміна В.Я.

Формування фотосинтетичних показників посівів різних за походженням сортів гречки в умовах Західного Лісостепу

Досліджено вплив низки мікроелементів на формування фотосинтетичних показників посівів різних за походженням сортів гречки в умовах Західного Лісостепу України. Встановлено, що застосування мікроелементів сприяло незначній варіативності досліджуваних показників. Більш суттєвим на них був вплив сортових особливостей гречки та погодних умов вегетаційного періоду. Разом із тим, отримано суттєву прибавку врожайності на варіантах застосування мікроелементів.

Ключові слова: *сорт, гречка, мікроелементи, площа листової поверхні, вміст хлорофілу в листках, коефіцієнт використання ФАР, урожайність*

Аннотация

Дорошенко Е.Л., Хомина В. Я.

Формирование фотосинтетических показателей посевов различных по происхождению сортов гречихи в условиях Западной Лесостепи

Исследовано влияние ряда микроэлементов на формирование фотосинтетических показателей посевов различных по происхождению сортов гречихи в условиях Западной Лесостепи Украины. Установлено, что применение микроэлементов способствовало незначительной вариативности исследуемых показателей. Более существенным на них было влияние сортовых особенностей гречихи и погодных условий вегетационного периода. Вместе с тем, получено существенную прибавку урожайности на вариантах применения микроэлементов.

Ключевые слова*: сорт, гречка, микроэлементы, площадь листовой поверхности, содержание хлорофилла в листьях, коэффициент использования ФАР, урожайность*