Original article
UDC 581.132.1:631.89:633.11

DEVELOPMENT OF PHOTOSYNTHETIC PROCESSES AND GRAIN PRODUCTIVITY OF WINTER WHEAT UNDER BIOLOGIZED FERTILIZER SYSTEMS

A. B. Author[1], A. O. Author[1], O. Y. Author[2]

[1]Institute of Agriculture of Carpathian Region of NAAS
Hrushevskoho street, 5, Obroshyne village, Lviv district, Lviv region, 81115

[2]Full name of organisation
Adress of organisation

About authors:

Alexander DUBYTSKYI
ORCID: 0000-0002-8293-4119

Anhelina DUBYTSKA
ORCID: 0000-0002-5685-0237

Oksana KACHMAR
ORCID: 0000-0002-0382-6030

Oksana VAVRYNOVYCH
ORCID: 0000-0003-3466-1432

Mariia SHCHERBA
ORCID: 0000-0002-0773-6382

For corresponding:
Oksana KACHMAR
e-mail: oksanaostrowska@ukr.net

Funding information: National Academy of Agrarian Sciences of Ukraine

[1]Інститут сільського господарства Карпатського регіону НААН
вул. Грушевського, 5, с. Оброшине, Львівський р-н., Львівська обл., 81115

[2]Повна назва установи
вул. Грушевського, 5, с. Оброшине, Львівський р-н., Львівська обл., 81115

Про авторів:

Олександр ДУБИЦЬКИЙ,
кандидат біологічних наук
ORCID: 0000-0002-8293-4119

Ангеліна ДУБИЦЬКА,
кандидат сільськогосподарських наук
ORCID: 0000-0002-5685-0237

Оксана КАЧМАР,
кандидат сільськогосподарських наук
ORCID: 0000-0002-0382-6030

Оксана ВАВРИНОВИЧ,
кандидат сільськогосподарських наук
ORCID: 0000-0003-3466-1432

Марія ЩЕРБА,
науковий співробітник
ORCID: 0000-0002-0773-6382

Для листування:
Оксана КАЧМАР
e-mail: oksanaostrowska@ukr.net

Інформація про фінансування: Національна академія аграрних наук України

For foreign authors, the Ukrainian translation will be provided by the journal's translator

Under field experiment conditions, the influence of biologized fertiliser systems on the content of chlorophylls (a + b) in upper leaves, net photosynthesis productivity (NPP) of crops, and grain productivity of winter wheat was studied.

Keywords: biologized fertiliser systems, winter wheat, chlorophyll content, net photosynthesis productivity, grain productivity.

Розвиток фотосинтетичних процесів та зернова продуктивність пшениці озимої за біологізованих систем удобрення

В умовах польового досліду вивчали вплив біологізованих систем удобрення на вміст хлорофілів (a + b) у верхніх листках, чисту продуктивність фотосинтезу (ЧПФ) посіву та зернову продуктивність пшениці озимої.....

Ключові слова: біологізовані системи удобрення, пшениця озима, вміст хлорофілів (*a* + *b*), чиста продуктивність фотосинтезу, зернова продуктивність.

For foreign authors, the Ukrainian translation will be provided by the journal's translator

Introduction. Grain production in Ukraine is a strategic and most effective sector of the national economy, as it forms the basis of the country's food supply and security. The state of grain production in recent years has been significantly affected by changes in natural and climatic conditions and insufficient material and technical support. Therefore, there is a need to develop new approaches to grain production based on both resource-saving technologies and rational use of zonal natural and climatic conditions [13, 14, 19, 20]. Today, research devoted to finding alternative, biologized means of increasing plant productivity, which are based on the activation of their natural metabolic processes, comes to the forefront [5, 12].....

Materials and methods. The research was conducted in 2021–2022 in a winter wheat field (*Triticum aestivum* L.) of the Benefis variety, sown after peas, under the conditions of a stationary experiment to study the scientific foundations of productivity management of short-rotation crop rotations in the Carpathian region.....

Results and discussion. Meteorological indicators during the research years had certain characteristics. Winter and spring-summer vegetation periods of winter wheat differed in the amount of precipitation. During winter and summer, it was 473.6 mm in 2021 and 318.3 mm in 2022, compared to the average long-term values of 458.0 mm (Table 1).

Table 1. Meteorological conditions during the research period (2021–2022)

Months	Опади				Air temperature, °C			
	mm		% norm		monthly average		difference from the norm	
	2021	2022	2021	2022	2021	2022	2021	2022
January	47.9	52.3	120	130	-1.5	-0.7	3.1	3.9
February	95.8	25.3	222	59	-2.8	-1.8	0.9	5.3
March	43.1	17.3	98	40	1.7	2.6	1.2	2.1
April	39.9	82.0	78	160	6.0	6.5	1.4	-0.9
May	55.4	24.3	65	29	13.1	13.9	0.2	1.0
June	97.3	31.3	104	32	19.3	19.7	3.0	3.4
July	94.2	85.8	92	84	22.2	19.5	4.7	2.0

Note: "–" – values below the norm.

A certain moisture deficit was noted in 2022 during March, May, and June. This deficit proved to be non-critical and did not significantly affect plant development and crop formation. Heat supply for winter wheat in the mentioned years was favourable for plant growth and development.

The chlorophyll content in winter wheat leaves does not provide a complete characterisation of the photosynthetic activity of crops. At the same time, photosynthetic potential can be expressed through net photosynthesis productivity (NPP, g/m² per day), which gives a more complete picture of the photosynthetic function of the crop. Under conditions of using variants formed on the basis of pea straw + $N_{90}P_{60}K_{60}$ (variants 3, 4, 5), during the flowering phase (F), net photosynthesis productivity indicators were within 5.22–6.08 g/m² per day (Fig. 1), which exceeded the corresponding value in the control variant.

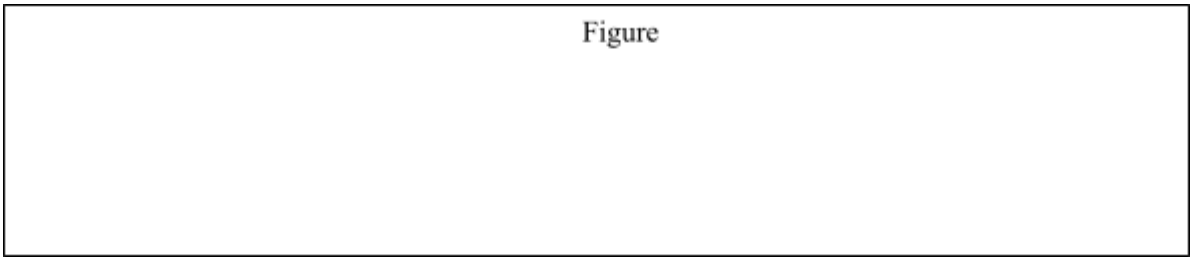


Fig. 1. Influence of biologized fertilizer systems on net photosynthesis productivity

During the milk-wax ripeness period, a decrease in net photosynthesis productivity was noted (Fig. 1) against the background of a slight decrease in the sum of chlorophylls (*a* + *b*) in winter wheat leaves (Table 2) in variants 3–5.

Conclusions. Thus, it was found that the use of biologized fertiliser systems positively affected the content of chlorophylls (*a* + *b*), net photosynthesis productivity, and winter wheat yield.

The content of the sum of chlorophylls (*a* + *b*) was highest during the flowering and milk-wax ripeness phases (variants with pea straw + $N_{90}P_{60}K_{60}$ + BS + HD or plant treatment with ChF) – 3.62–3.38 and 3.78–3.64 mg/g fresh weight. This caused an increase in the number of grains per spike and 1000-grain weight to 36.1–40.5 g, which resulted in an increase in grain productivity of the crop to 4.60–5.54 t/ha.

References

Bohdan M. M., Karpenko V. P., Huliaieva H. B. The influence of complex chelated fertilisers on the functional activity of root tissues and grain productivity of soft winter wheat plants. *Bulletin of Uman National University of Horticulture*. 2015. No. 1. P. 37–42.

The content of photosynthetic pigments in spelled wheat plants as a criterion of productivity under traditional and organic growing technologies / I. V. Korotkova et al. *Innovative Biosystems and Bioengineering*: International Scientific E-Journal. 2022. Vol. 6, No. 1. P. 31–39.