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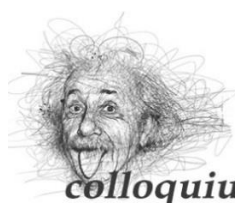
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INFLUENCE OF GROWTH STIMULANTS ON THE ONTOGENESIS OF SPRING BARLEY (*HORDEUM VULGARE* L.)41

Horobets Maksym,
Applicant for the highest degree of Doctor of Philosophy
Chaika Tetiana,
candidate of economical sciences
Krykunova Valentyna,
candidate of chemical sciences
Associate Professors
Poltava State Agrarian Academy
Poltava, Ukraine

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INFLUENCE OF GROWTH STIMULANTS ON THE ONTOGENESIS OF SPRING BARLEY (*HORDEUM VULGARE* L.)

Abstract.

An investigation of the importance of growth factors for accumulation of solids in spring barley (*Hordeum vulgare* L.) plants at different stages of organogenesis is established, the influence of growth factors on the elements of structure and productivity of spring barley is specified. The use of growth regulators in crop production along with other agricultural practices of intensive and biologized tillage technologies is one of the most advantageous and promising methods of improving crop yields. Spring barley plants were treated with the stimulants Epin-extra, Zircon and 1 % bischofite in the tillering phase. As a result of the research, it was found out that spraying of crops in the tillering phase with the growth regulators Epin-extra, Zircon and 1 % bischofite reduces the growing season by 2–4 days when treating spring barley on sod-podzolic soil; the growth regulator Epin-Extra and 1 % bischofite increase the assimilation leaf surface of plants by 8.5 and 11.1% respectively, the photosynthetic potential by 5.7 % and the net productivity of photosynthesis by 3 and 10 %; the growth regulator Zircon does not have a positive effect on the photosynthetic activity of spring barley plants under soil and climatic conditions.

Keywords: plant growth regulators, leaf surface area, photosynthetic activity, photosynthetic potential, net productivity of photosynthesis

In the modern technologies of spring barley (*Hordeum vulgare* L.) treatment great importance is attached to various methods of treatment of both seeds and plants with environmentally friendly new preparations in order to improve yields. One of the most promising directions of the modern technology for crop production is the use of plant growth stimulants [1]. Growth stimulants activate the immune system of the plant (spring barley), enable to 'smooth' the limiting factors of obtaining potential yields, improve resistance to drought or excess moisture at high or low ambient temperatures, as well as accelerate or slow down the maturation of plants, increase the number of seeds in the ear, contribute to the redistribution of nutrients in economically important plant organs. These conditions cannot be provided by the traditional elements of the technology [2, 3, 4].

Thus, our research is relevant and deals with the study of growth stimulants influence on the ontogenesis of spring barley (*Hordeum vulgare* L.).

Field experiment was carried out during 2017–2019 on the experimental field of the Poltava State Agrarian Academy (Ukraine) and barley Helios, Vakula and Parnassus cultivars were used as test crops. All cultivars are Ukrainian breeding and recommended for grown in the Forest-Step zone of Ukraine. Institute of Plant Breeding named after V. Ya. Yuriev of National Academy of Agrarian Sciences of Ukraine is originator of the barley cultivars.

Characterizing the results of seedlings and full maturity of the studied cultivars of spring barley (*Hordeum vulgare* L.) in 2019, it should be said that for

the cultivar 'Helios', treatment with Zircon led to the emergence of seedlings on 11.05.19, which is 3 days faster than the control. And the full maturity was on 3.07.19, which is 2 days faster than the control. The best stimulant was Zircon. For 'Parnassus' cultivar the seedlings appeared on 12.05.19, and the full maturity was on 12.07.19 under the action of Zircon as well. 'Vakula' cultivar in 2019 had seedlings on 14.05.19, and the full maturity – on 6.07.19. Such indicators did not show a significant advantage of the stimulants used for growing this cultivar of barley.

Thus, the use of Zircon and 1 % bischofite solution (for 'Helios' and 'Parnassus' cultivars) accelerated the earing phase by 2–4 days, Epin-extra – only by 1–2 days. The effect of stimulants on the growth rate of spring barley plants was observed in the maturity phase of barley grain, as a result of which the barley grain treated with stimulants matured 2–4 days earlier than in the control, this is due to the fact that stimulants accelerated processes of metabolism in plants, thereby promoting maturation. Therefore, 1 % bischofite solution and Zircon most actively promoted the approach of subsequent phases of plant development in the control field. In the control variant, the phenological phases came later, so on average, for 3 years of the experiment, the duration of the growing season in this variant was 92 days.

When treating with different stimulants, the duration of the phases (stem elongation – earing, earing – full maturity) differ greatly, which is due to specific weather conditions in the period of the experiment

(2017–2019). Thanks to the use of stimulants, the duration of the growing season of spring barley plants was reduced by 2–5 days in 2017 compared to the control. It was the shortest when using Zircon and 1 % bischofite solution, while the growing season in both cases was 86 days. It should be noted that the effect of Zircon and 1 % bischofite solution was especially evident in the following periods: tillering – stem elongation and earing – full maturity, because each of these periods was reduced by 2 days relative to the control (for the cultivars ‘Helios’ and ‘Parnassus’). The use of Epin-Extra was manifested in the reduction of these periods by only 1–2 days.

In 2018, when using Zircon and 1 % bischofite solution, the duration of each subsequent phase of the development of spring barley plants was the shortest, and these stages were reduced by 1–3 days relative to the development phases, and the growing season was 6 days shorter than the control. The use of Epin-extra on crops also accelerated the development of spring barley (*Hordeum vulgare* L.), and the growing season was reduced by only 3 days and amounted to 87 days.

In 2019, the duration of development phases of spring barley plants differed slightly from previous years of the research (2017–2018). In variants through the use of stimulators the period of tillering – stem elongation was reduced by 1 day. The next period: stem

elongation – earing differed greatly from previous years, as under the action of Zircon the period was reduced by only 1 day, and under the action of 1 % bischofite solution the reduction in maturity of spring barley ‘Vakula’ was not detected. The stimulant Epin-extra increased this period by 3 days, but reduced the stage of earing – full maturity by 3 days. In general, under our experimental conditions, the regularity of reduction of the growing season under the influence of stimulants was kept. It was most pronounced when treating spring barley crops (cultivars ‘Helios’ and ‘Parnassus’) with stimulants such as Zircon and 1 % bischofite solution.

The use of Epin-extra promoted increasing the period of stem elongation – earing by 1–3 days (table 1). The growing season was reduced by 2–4 days. Thus, through the use of Epin-extra the maturity was on the 90th day after emergence of seedlings, when using Zircon and 1 % bischofite solution – on the 88th, and in the control variant – on the 92nd day [5].

Optimally oriented in space photosynthetic system of spring barley crops, mainly leaf surface, ensures the most complete use of soil and climatic resources of the region and enables to get a maximum effect from the methods of agrotechnical influence (table).

Table

Leaf surface area in the earing phase of the spring barley cultivars under study for 2017–2019, thousand m²/ha

Variant of stimulant	Average for 3 years ‘Helios’	Deviation from the control (±)		Average for 3 years ‘Vakula’	Deviation from the control (±)		Average for 3 years ‘Parnassus’	Deviation from the control (±)	
		thousand m ² /ha	%		thousand m ² /ha	%		thousand m ² /ha	%
Control	35.1	–	–	36.5	–	–	36.2	–	–
Epin-extra	36.8	3.3	6.7	36.7	4.2	8.8	37.1	4.7	8.2
Zircon	35.4	1.2	5.3	36.9	1.8	1.2	37.5	2.1	1.4
1% bischofite solution	39.4	2.8	6.5	39.1	2.3	11.8	38.3	1.8	11.4
HCP ₀₅	0.8	–	–	0.9	–	–	0.8	–	–

During the research it was found out that at the time of treating the crops in the tillering phase with the growth stimulants Epin-extra, Zircon and 1 % bischofite solution the growing season reduces by 2–4 days when growing spring barley on sod-podzolic soils; the stimulant Epin-extra and 1 % bischofite solution increase the assimilation leaf surface of spring barley (*Hordeum vulgare* L.) plants by 8.5 and 11.1 % respectively, the potential of a photosynthetic process by 5.7 % and the net productivity of photosynthesis by 3 and 10 %.

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