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SUNFLOWER (*HELIANTHUS ANNUUS* L.) PRODUCTIVITY UNDER THE EFFECT OF AKM PLANT GROWTH REGULATOR IN THE CONDITIONS OF THE SOUTHERN STEPPE OF UKRAINE

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Aim. The goal of this research was to determine the influence of AKM plant growth regulator on the performance of large-seed Lakomka sunflower variety, sowing and yielding properties of seeds. **Methods**. Agrochemical and biometric methods. Mathematical analysis of the results was carried out by Student's test and licensed Agrostat computer program. **Results.** The results of the study on the impact of AKM plant growth regulator (PGR) on growth, development and yield formation of sunflower in low moisture conditions of Southern Steppe of Ukraine are presented. Pre-sowing seed treatment of Lakomka sunflower variety with AKM plant growth regulator causes an increase in leaf surface area by 22 %; pollen fertility – by 27 %; reduces the phenological phases by 2–4 days on average, increases the resistance of sunflower plants to abiotic stress and increases yield by 26 %. It is proven that the proportion of the impact of water stress of the studied year (58.4 %) is significantly higher than that of the impact of PGR (32.7 %). **Conclusions**. AKM plant growth regulator is recommended for the use on sunflower in 0.015 g/l concentration.

Keywords*:* sunflower, productivity, plant growth regulator, hydrothermal conditions, growth and development of the plants, stress resistance.

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INTRODUCTION

The plant growth depends on the weather conditions during the entire production cycle, starting with sowing and ending with harvesting. The factor of weather risk, which significantly affects the yield of crops, is objective and one of the least predictable. By their genesis weather risks are external, not related directly to the activities of the enterprise [1]. Therefore, the production of sunflower seeds, as well as other crops in many farms of the Steppe zone of Ukraine is distinguished by the decrease in yield and its stability and the increase in the cost of production.

There are two ways to increase plant resistance to stresses: improving the genetic basis of such resistance or using a specific plant growing technology. The latter can be achieved by the differentiated use of plant growth regulators (PGR) which can stimulate plant growth and development, increase the sunflower plant resistance to various stress factors and increase the yield of plants [2, 3].

The increase of crop productivity with the use of PGRs relates to the fact that they intensify the activity of plant cells, increase the permeability of intercellular membranes and accelerate biochemical processes in them, which leads to the optimization of the processes of nutrition, respiration and photosynthesis. As a result, plants have higher resistance to adverse weather conditions and to pests and disease harmfulness. Plant growth regulators contribute to the realization of the genetic potential of plants to a higher level [4–6].

The efficiency of growth regulators in oilseed sunflower cultivation technologies was studied by I.I. Klimenko, Y.I. Buryak and other scientists [3, 7], who used growth regulators with active substances of different origin and mechanisms of influence on plants. It was determined that in case of pre-sowing treatment of sunflower seeds with different growth regulators, the field germination increased by 3−17 %, the yield of sunflower – by 0.14−0.21 t/ha, primarily by increasing the weight of 1,000 seeds and the number of full seeds in the inflorescence.

Hernandez claimed that different plant growth regulators (N6-benzyladenine (BA), a-Naphthaleneacetic acid (NAA) and Gibberellic acid (GA3)) contribute to the increase in the leaf surface area by an average of 38 % and stimulate the growth processes of sunflower plants, while causing reduction in the duration of the phases of plant growth and development [8].

According to a group of scientists: Sibgha Noreen, Muhammad Ashraf, Mumtaz Hussain and Amer Jamil [9], the use of salicylic acid as a growth regulator for sunflower cultivation reduces the negative impact of stressors by increasing the activity of antioxidant enzymes (superoxide dismutase, catalase and peroxidase). In addition, growth processes and photosynthetic activity of sunflower plants are activated.

The efficiency of growth regulators in case of sufficient moisture and abidance of the growing technology has been well studied and proved to be quite high. At the same time, fewer investigations have been dedicated to growth regulators in low and unstable moisture conditions and high temperatures in field crop cultivation in general and large-seed sunflower varieties in particular, leading to current study. The goal of this research was to determine the influence of AKM plant growth regulator on the performance of large-seed Lakomka sunflower variety, sowing and yielding properties of seeds.

MATERIALS AND METHODS

Iodine solution (for the sunflower pollen fertility determination) was prepared by Gram recipe: 2 g of potassium iodide was dissolved in 5 ml of distilled water when heated. Then 1 g of metallic iodine was added into solution, which was brought to 300 ml and stored in an orange glass.

Alkalis, acids, solvents, Mohr’s salt and other reagents have been purchased at “Khimlaborreaktyv” company (Kyiv, Ukraine).

The soil samples were collected from the experimental plot and air dried. Then all the roots were carefully removed, the soil was rubbed in agate mortar and sieved through a sieve with 0.25 mm holes.

The humus content in the soil samples was determined using I.V. Turin’s method. It is based on the oxidation of soil organic matter by 0.4 n solution of potassium bichromate ($K_2Cr_2O_7$) till the formation of carbon dioxide. The reaction occurs by the equation:

$$3C + K_2Cr_2O_7 + H_2SO_4 = 2K_2SO_4 + 2Cr_2(SO_4)_3 + \\ + 8H_2O + 3CO_2.$$

The residue of chromic mixture, not used for oxidation purposes, was titrated by Mohr’s salt (double salt) of ammonium sulfate and iron oxide sulphate $[(NH_4)_2SO_4\ FeSO_4]\cdot 6H_2O$. The residue of chromium compounds was determined by the number of consumed Mohr’s salt, and by the difference between the original amount (idling determination result), and the remainder amount of chromium compounds, which went to the oxidation of humus.

Definition of hydrolyzed nitrogen by Cornfield [10]. The principle of the method is that soil is hydrolyzed using alkali. As a result, nitrogen of exchangeable ammonium, amide, aminosugars, and other compounds is released from the soil in the form of NH_3, which is caught by boric acid.

Determination of mobile forms of phosphorus and potassium in the soil using Chirikov method (DSTU 4115-2002). The method is based on “extraction” of phosphorus and potassium from the soil by 0.5 normal acetic acid at a ratio soil:solution (1:25) followed by phosphorus determination as molybdenum blue on photoelectric colorimeter, and potassium − on flame photometer.

The method of comprehensive lipid extraction (Soxhlet method) is based on the highest possible lipid extraction from the analyzed material by repeated treatment with solvent until the lipid content in the material becomes insignificant. The solvent is then distilled off from the resulting extract and the residue containing lipids is dried in conditions that preclude its oxidation, and then weighed (DSTU 7577:2014).

Determination of pollen fertility by iodine method [11]. It is based on the determination of starch using iodine reaction. Fertile and sterile pollen grains vary in starch content. Usually fertile pollen grains are completely filled with starch and sterile ones have none of it at all or contain only traces.

Equipment. To receive quantitative indicators during experiments on the definition of soil quality, fertility of pollen of flowers and seeds of sunflower the following equipment was used: analytical scales ANG220 (AXIS, Poland), binocular microscope THS08-04B-RC 40x-1000x (Henan, China), Multifuge centrifuge (Thermo/Heraeus, Germany), two-channel flame photometer CL22 (Russian Federation), scanning spectrophotometer UV-2800-UNICO (Russian Federation).

Soil and climatic conditions of research conduction. The study was conducted in 2011–2013 in “Agrofirma MIR” LLC of Melitopol district of Zaporizhzhya region and in the laboratory of monitoring of soil and crop products quality of the Research Institute of Agrotechnologies and Ecology of Tavria State Agrotechnological University.

Soil of the experimental plots was southern chernozem with average weighted humus content of 3.7 %, easily hydrolyzed nitrogen (by Cornfield) − 95 mg/kg, mobile phosphorus (by Chirikov) − 117 mg/kg and exchangeable potassium (by Chirikov) − 145 mg/kg of the soil. The results were compared with the standards of soil fertility indexes for agricultural lands, established by DSTU (DSTU 4362:2004).

Soil moisture conditions in the research years differed, both by the rainfall amount, and its uniformity (Table 1). Almost the same amount of precipitation during the growing season was observed in 2012 − 129 mm and 2013 − 122 mm, while in 2011 there was twice more precipitation − 249 mm. At the same time, 2012 and 2013 were distinguished by irregular rainfall, high temperatures and large soil drought during the period from germination to seed maturation. HTC indexes varied within the limits of 0.4−0.9 over the years. Hydrothermal conditions in 2011 compared to 2012 and 2013 were more optimal both by amount and uniformity of rainfall.

Scheme of field experiment. In order to address the stated objectives and goal, the two-factor field experiment was laid, which provided seed treatment with AKM plant growth regulator [13] – factor A and determination of the effectiveness of its action under hydrothermal conditions of the year of the research − factor B (Table 2). Seed treatment was carried out 1−2 days before sowing by incrustation method at the rate of 10 l of working solution per 1 ton of seeds.

Studied preparation characteristics. The study of ionol influence on the growth and development of agricultural crops was started in the 80−90’s of XX century [14]. Ionol (2,6-di-tert-butyl-4-methylphenol) is not only an effective free radical and hydroperoxide inhibitor. It prevents the development of oxidative stress in the cells of plants and seeds, and controls apoptosis, cell division, differentiation of organelles and ultrastructure of plastids, thus regulating plant growth and development, increasing their adaptive capabilities, especially under adverse conditions during germination and vegetation [15, 16].

Dimethyl sulfoxide is an antioxidant that binds active forms of oxygen, including the most toxic OH radicals, and in concentrations of 0.1 mmol/l shows mild stimulating effect on the process of oxidative phosphorylation, increasing the energy potential of the organism [17]. Thanks to the ability of DMSO to penetrate through cell membranes without damaging the active transport of biologically active substances, its complex

Table 1. Hydrothermal conditions of the growing season of sunflower during research years

Indexes	2011	2012	2013
Rainfall during the growing season, mm	249	129	122
The sum of active (above +10 ^{o}C) temperatures, ^{o}C	2787	2889	2996
CHU	3285	3334	3519
Hydrothermal coefficient	0.89	0.44	0.41
Minimum relative air humidity during flowering, %	49.9	32.8	61.8

(Crop Heat Units − CHU) [12].

Table 2. The scheme of field experiment

Variant	Preparation consumption rate, l/t	Concentration of active substance in the working solution, g/l
1 (K)	Seed treater − Derozal, 1.5	–
2	K + AKM, 0.330	Ionol + dimethyl sulfoxide, 0.015

with ionol has a significant synergistic effect on seed germination [18, 19].

The staff of the Tavria State Agrotechnological University have developed AKM growth regulator of antioxidant type, where ionol and dimethyl sulfoxide antioxidants form a composition with polyethylene glycols of different molecular weight [13, 20].

The technology of sunflower cultivation in the experiment. Sunflower seeds were sown early in the third decade of April, the rate of sowing was 45,000 seeds/ha with 70 cm row spacing. The predecessor of sunflower was winter wheat. The care of crops, estimation and monitoring of growth and development of plants, yield structure formation of sunflower were carried out according to the Methods of field experience (with the fundamentals of statistical processing of study results) [21]. Pollen fertility was determined by iodine method, based on the determination of starch using iodine reaction [22]. Seeds from the inflorescence were taken after drying in the air to determine the mass of 1,000 seeds [21, 23].

The mathematical analysis of the results was carried out by Student's test [24] and licensed Agrostat computer program.

RESULTS AND DISCUSSION

Vegetative sunflower plant productivity depends on pre-sowing seed treatment by AKM growth regulator and hydrothermal conditions of the year. Germination of the seeds is one of the most critical stages in the life of the plant. The use of pre-sowing seed treatment activates self-regulation processes and improves germination and resistance to adverse environmental factors [25]. We have determined that the incrustation of sunflower seeds by AKM plant growth regulator stimulates germination, which is proven by increasing germination vigor by 1.8−5.1 percentage points (p. p.) relative to the control [26].

The effect of growth regulators on the germination in field conditions depends on the hydrothermal conditions of the year, especially on rainfall at the stage of seed germination. Very low rainfall in 2012 − 5.9 mm during seed germination (BBCH – 00−09) led to the reduction in field germination of untreated seeds by 29.6 p. p. relative to optimal moisture in 2011 (Table 3). The field germination of seeds, treated with AKM plant growth regulator during studied years, had a similar pattern to that of the control, but the difference between optimal by moisture and the driest years was 20 p. p. In 2011, no difference in field germination between control and experimental variants was observed.

AKM PGR had significant effect on plant height and diameter of the stem in all studied years. For instance, in 2011, the most humidified year, plant height increased by 8 %, and stem diameter – by 15 %, which was a good measure against laying of crops.

Under AKM action the number of leaves per plant increased by 3−9 % compared to the control (Table 3). The effect of hydrothermal conditions on the effectiveness of PGR impact on the performance of vegetative sunflower plant productivity was the same. The photosynthetic activity of plants depended on leaf surface area. In our studies the leaf surface area was determined at the stage of plant development, BBCH – 61−65. The experimental variant exceeded the control by an aver-

Table 3. Vegetative sunflower plant productivity, depending on pre-sowing seed treatment by AKM growth regulator and hydrothermal conditions of the year

PGR (factor A)	Year (factor B)	Field germination, %	Plant height, m	Stem diameter, cm	Amount of leaves, units per plant	Leaf surface area, thousand m²/ha
No PGR	2011	73.1	1.57	2.7	28.4	29.3
	2012	56.4	1.43	2.2	19.4	15.5
	2013	69.8	1.35	2.3	22.3	18.4
	average	66.4	1.45	2.4	23.4	21.1
AKM	2011	73.6	1.59	2.9	29.1	33.7
	2012	61.3	1.55	2.6	20.6	23.5
	2013	72.9	1.46	2.7	24.6	22.7
	average	69.3	1.53	2.7	24.8	26.6
LSD_{05} A		1.1	0.19	0.2	0.5	0.8
B		1.7	0.04	0.1	0.9	1.5

age of 22 % for this index. Because of better moisture supply, sunflower plants in 2011 formed a larger leaf surface area than in other years studied. Attention is drawn to the fact that the difference between research variants in more stressful 2012 was maximal (34 %), proving that AKM PGR showed anti-stress properties. A correlation of high strength (r = 0.999) was found between the leaf surface area of the crop and rainfall (BBCH – 00−65) and this gives grounds to including the investigated PGR to plant growth stimulators. The share of AKM PGR impact (factor A) on the formation of the leaf surface area was 39.3 %.

The structure of sunflower yield under AKM growth regulator action depending on hydrothermal conditions of the year. The plant density in studied years was low (Table 4). Because of unfavorable hydrothermal conditions, crop irregularity was observed in the arrangement of sunflower plants. We established a correlation (r) between the plant density and HTC (BBCH – 00−09), equal to 0.712 (control) and 0.804 (AKM).

The diameter of the inflorescence depended on the moisture supply of sunflower plants in inflorescence formation stage (BBCH – 51−53). Under PGR effect, the diameter of inflorescence increased, especially in the dry 2012, when this figure exceeded control by 13 %. The medium strength correlation (r = 0.588) was found between rainfall in the phase of rapid inflorescence growth and its diameter.

PGR had significant influence on seed weight in the inflorescence, which increased by 9−19 % under the influence of AKM compared to control. In the dry 2012 the effect of the PGR was maximal, indicating the anti-stress effect of AKM on the formation and maturation of seeds. There was a close correlation between the mass of seeds from 1 inflorescence and rainfall (BBCH – 51−87): in the control variant, it was (r = = 0.953), and in the experimental variant − r = 0.864. Thus, PPP reduced the negative effect of drought.

The positive impact of PGR on the formation of vegetative and generative organs of sunflower plants was reflected in such integrated index as biological productivity (Table 4), which increased by 10−26 % under the influence of AKM. The greatest influence on the sunflower yield was demonstrated by AKM in the dry 2012, when it increased by 26 % relative to the control. In general, both studied factors significantly affected the sunflower yield, but the proportion of the impact of water stress of the studied year (factor B) (58.4 %) was significantly higher than that of the impact of PGR (factor A) (32.7 %). This should be considered when developing anti-stress techniques in technologies of sunflower cultivation in the Steppe zone of Ukraine. Analyzing the impact of hydrothermal conditions of the year on the formation of biological yield of sunflower, we have established a close relationship between the relative humidity during the growing season and yield, where the correlation coefficient was 0.939 in control, and 0.990 – in the experimental variant. The correlations between biological yield and rainfall and the amount of active temperatures were weak, while with the accumulation of heat units (CHU), this relationship was average and correlation coefficient was 0.383 for the control and 0.569 for the experimental variant.

Table 4. Structure of sunflower yield under AKM growth regulator action depending on hydrothermal conditions of the year

PGR (factor A)	Year (factor B)	Plant density, thousand units/ha	Inflorescence diameter,cm	Seed weight in 1 inflorescence, g	Biological yield, t/ha	Rate of the genetic potential of the variety realization, %
No PGR	2011	32.9	21.4	79.0	2.6	74.3
	2012	25.4	18.9	55.1	1.4	40.0
	2013	31.4	23.7	86.0	2.7	77.1
	average	29.9	21.3	73.4	2.2	63.8
AKM	2011	33.1	22.5	86.8	2.9	82.9
	2012	27.6	21.8	67.9	1.9	54.3
	2013	32.8	23.9	100.6	3.3	94.3
	average	31.2	22.7	85.1	2.7	77.2
LSD_{05} A		0.3	0.3	1.1	0.1	
B		0.2	0.3	0.8	0.2	

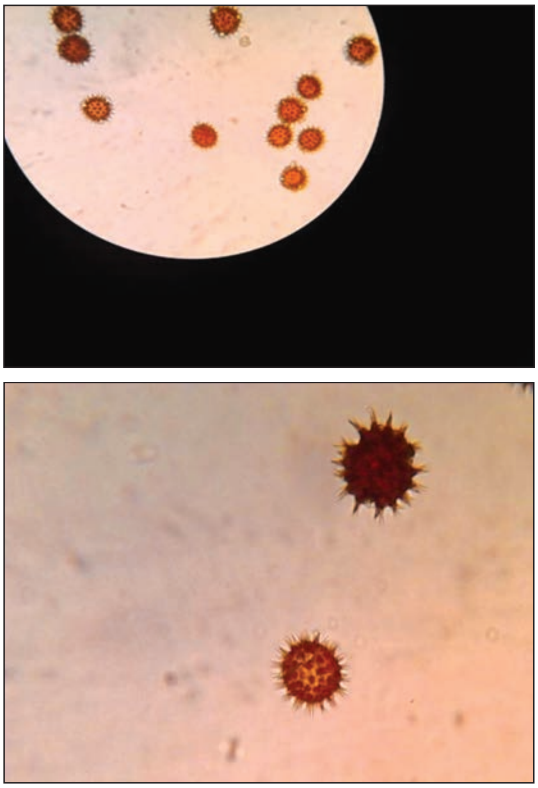

Fig. 1. Pollen grains after coloring by iodine method under a microscope (own photos)

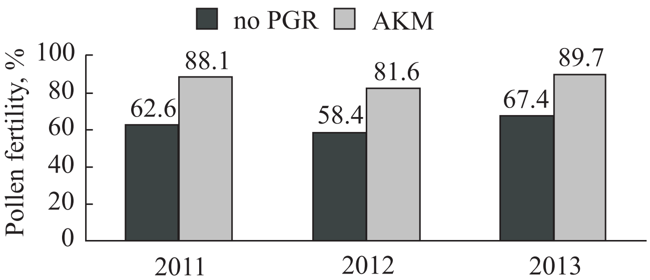

Fig. 2. Sunflower pollen fertility of Lakomka variety under AKM growth regulator action depending on hydrothermal conditions of the year

Sunflower pollen fertility of Lakomka variety under AKM growth regulator action depending on hydrothermal conditions of the year. In the Steppe zone of Ukraine during the flowering period of sunflower, the daytime temperature rises to 40 ºC, and at such temperatures pollen is drying, which in turn leads to an increase in its sterility. It is determined that fertility and sterility of pollen cells differ by starch content. Its normal content matches the final stage of sperm formation. Fertile pollen grains are completely filled with starch, while sterile ones do not contain it at all or only have traces (Fig. 1).

Pre-sowing seed treatment by PGR influenced the development of flower primordia considerably (Fig. 2). Thus, sunflower pollen fertility in the experimental variant increased by 27 % compared to the control on average for years. Relative air humidity had the greatest influence on the fertility of sunflower pollen. Thus, the connection between research features was very high and the correlation coefficient was equal to 0.990 for control and 0.973 for AKM PGR. The sum of active temperatures during flowering (BBCH – 61−69) had a significant impact on pollen fertility. In control, the variant correlation coefficient equaled 0.904, and the variant with AKM − 0.684.

Sunflower seed quality of Lakomka variety under AKM growth regulator action depended on hydrothermal conditions of the year. Seed emptiness of sunflower seeds depended on pollen fertility. This index, similar to the mass of 1,000 seeds, was determined in three different zones of the inflorescence (outside, middle, and central). The highest seed emptiness was observed in the center of the inflorescence (Table 5). In control variant, it was higher compared to the experimental variant on average by 9.3 p.p.

Relative air humidity during flowering had the greatest influence on the formation of empty sunflower seeds. The relationship between these indices was strong and inverse in all the zones of inflorescence. The highest correlation coefficient was in the central zone, amounting to $r = -0.964$ in control and $r = -0.995$ in AKM PGR variant. In the control variant, the correlation coefficient gradually decreased and in the outside zone equaled −0.761. At the same time in the PPP AKM variant it almost did not depend on the inflorescence zone. A similar dependence was observed between seed emptiness and the active temperatures, although it was weaker.

The weight of 1,000 seeds depended on fullness and emptiness of seeds. Maximally full seeds were formed in the outside zone of sunflower inflorescence. Under the effect of AKM plant growth regulator, the weight of 1,000 seeds increased by an average of 17−33 % depending on the area of the inflorescence. The maximum deviation of the mass of 1,000 seeds was notable for the seeds within the central zone of the inflorescence. Under optimal conditions of growth and development, large-seed Lakomka sunflower variety formed seeds with the weight of 1,000 seeds – 120−130 g. In our case, the plants of control variant had almost twice lower mass of 1,000 seeds. AKM PGR contributed to the formation of greater mass of 1,000 seeds, but the genetic potential of plants was realized only by 81 %. No significant correlation was found between 1,000 seeds weight and rainfall (BBCH – 61−87). At the same time, there were considerable inverse correlations between the weight of 1,000 seeds and the active temperatures (BBCH – 61−87) with the correlation coefficient of −0.999 for the control variant and from −0.608 to −0.925 for the experimental variant, depending on the zone of the inflorescence.

AKM plant growth regulator influences not only seed emptiness and weight of 1,000 seeds but also the seed size − its length (Table 6). Under the application of growth regulator, the seed fraction with the length of > 7 mm on average for research years was 67.2 % and in 2011 – 86 % of the total seeds, which is 25 p. p. more compared with the control. At the same time the fractions with shorter length of seeds dominated in the control variant.

Only a tendency to changing seed desquamation was found during the studied years between the control and the variant using AKM PGR. In years with unfavorable hydrothermal conditions, a thicker seed shell was formed.

The highest oil content in sunflower seeds was in 2011 with favorable hydrothermal conditions. Under the application of growth regulator, there was a tendency to increasing oil content in seeds.

CONCLUSIONS

It was determined that the incrustation of sunflower seeds with AKM plant growth regulator stimulated

Table 5. Seed emptiness and weight of 1,000 seeds of Lakomka sunflower variety depending on the development zone of the inflorescence

PGR (factor A)	Year (factor B)	Seed emptiness, %			Weight of 1,000 seeds, g		
		Zone of the inflorescence			Zone of the inflorescence		
		Outside	Middle	Central	Outside	Middle	Central
No PGR	2011	6.5	12.5	31.1	87.2	72.8	49.1
	2012	7.3	14.7	35.7	84.3	61.5	45.3
	2013	5.2	13.4	30.2	95.3	82.1	52.3
	average	6.3	13.5	32.3	88.9	72.1	48.9
AKM	2011	4.7	8.5	22.4	102.3	94.2	78.9
	2012	4.9	10.4	25.5	101.2	92.7	67.7
	2013	4.1	7.6	20.9	118.5	101.4	74.3
	average	4.6	8.8	22.9	107.3	96.1	63.6
LSD_{05} A		0.2	0.1	0.3	1.3	1.6	0.9
B		0.4	0.2	0.3	0.8	0.7	1.7

Table 6. Sunflower seed quality of Lakomka variety under AKM growth regulator action depending on hydrothermal conditions of the year

PGR (factor A)	Year (factor B)	Fractions of seeds by length, %			Desquamation, %	Oil content, %
		5–6 mm	6.1–7 mm	>7 mm		
No PGR	2011	10	29.0	61.0	27.5	44.7
	2012	20	52.8	27.2	29.1	43.6
	2013	22	53.4	24.6	28.6	42.5
	average	17.3	45.1	37.6	28.4	43.6
AKM	2011	2.0	12.0	86.0	27.9	45.3
	2012	9.8	34.2	56.0	28.6	44.9
	2013	8.9	31.5	59.6	28.3	43.6
	average	6.9	25.9	67.2	28.3	44.6
LSD_{05} A					0.3	0.2
B					0.5	0.3

seed germination, confirming the increase in field germination by 4.9 p. p. relative to the control. The plant growth regulator caused the activation of the growth process, which was particularly manifested through the height of plants – which was increased by 8 %, and stem diameter – by 6.9−15 %. The increase in the leaf surface area of the crop by 39.3 % was defined by plant growth regulator and greatly depended on rainfall (*r* = = 0.999) during the period of 00−65 on BBCH scale. The inflorescence diameter increased under PGR action, which was especially evident in the dry 2012, when this figure exceeded the control by 13 %. Medium correlation (*r* = 0.588) was determined between rainfall in the phase of rapid growth and inflorescence diameter. AKM action increased seed weight in the inflorescence by 9–19 % compared to control. Growth regulator affected the yield of sunflower significantly − the share of a factor in the formation of yield was 32.7 %. The share of the impact of water deficit was 58.4 % on average over the years of research. Due to the use of PGR, the fertility of sunflower pollen increased by 27 % compared to the control, and seed emptiness was reduced by 9.3 p. p. in different zones of the inflorescence. Pollen fertility and seed emptiness of sunflower depended on relative humidity during flowering – *r* = 0.990 for the control plants and *r* = 0.973 in case of AKM application. The weight of 1,000 seeds increased under PGR action by an average of 17−33 % depending on the zone of the inflorescence. An inverse correlation was found between 1,000 seeds weight and the amount of active temperatures (BBCH – 61−87): *r* = −0.999 for the control variant and *r* = −(0.608– –0.925) for PGR treatment depending on the zone of the inflorescence.

Продуктивність рослин соняшнику (*Helianthus annuus* L.) під дією регулятора росту АКМ за умов Південного Степу України

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Мета. Встановлення впливу регулятора росту рослин АКМ на продуктивність великоплідного сорту соняшнику Лакомка, посівні та врожайні властивості насіння. **Методи.** Агрохімічні і біометричні методи. Математичну обробку отриманих результатів проводили за критерієм Ст'юдента та ліцензованою комп'ютерною програмою Agrostat. **Результати.** Наведено результати досліджень щодо впливу регулятору росту рослин (РРР) АКМ на ріст, розвиток і формування врожаю соняшнику за умов недостатнього зволоження Південного Степу України. Передпосівна обробка насіння соняшнику сорту Лакомка регулятором росту рослин АКМ обумовлює збільшення площі листкової поверхні на 22 %; фертильність пилку – на 27 %; скорочує тривалість фенологічних фаз розвитку в середньому на 2–4 доби, підвищує стійкість рослин соняшнику до абіотичних стресів та збільшує врожайність на 26 %. Доведено, що частка впливу водного дефіциту року дослідження (58,4 %) значно перевищує частку впливу РРР (32,7 %). **Висновки.** Рекомендовано застосовувати регулятор росту рослин АКМ на посівах соняшнику у концентрації 0,015 г/л.

Ключові слова: соняшник, продуктивність, регулятор росту рослин, гідротермічні умови, ріст і розвиток рослин, стійкість до стресів.

Продуктивность растений подсолнечника (*Helianthus annuus* L.) под действием регулятора роста АКМ в условиях Южной Степи Украины

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Цель. Определение влияния регулятора роста растений АКМ на продуктивность крупноплодного сорта подсолнечника Лакомка, посевные и урожайные свойства семян. **Методы.** Агрохимические и биометрические методы. Математическую обработку полученных результатов проводили с помощью критерия Стьюдента и лицензированной компьютерной программы Agrostat. **Результаты.** Представлены результаты исследований по влиянию регулятора роста растений (РРР) АКМ на рост, развитие и формирование урожая подсолнечника в условиях недостаточного увлажнения Южной Степи Украины. Предпосевная обработка семян подсолнечника сорта Лакомка регулятором роста растений АКМ обусловливает увеличение площади листовой поверхности на 22 %; фертильность пыльцы – на 27 %; сокращает длительность фенологических фаз развития в среднем на 2–4 дня, повышает стойкость растений подсолнечника к абиотическим стрессам и увеличивает урожайность на 26 %. Доказано, что доля влияния водного дефицита года исследования (58,4 %) значительно превышает таковую влияния РРР (32,7 %). **Выводы.** Рекомендовано использовать регулятор роста растений АКМ на посевах подсолнечника в концентрации 0,015 г/л.

Ключевые слова: подсолнечник, продуктивность, регулятор роста растений, гидротермические условия, рост и развитие растений, стойкость к стрессам.

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