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PECULIARITIES OF WATER CONSUMPTION OF SPRING CAMELINA UNDER THE INFLUENCE OF ADDITIONAL NUTRITION WITH DIFFERENT SOWING METHODS

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The presented data are relevant due to the need to determine effective measures for increasing the seed productivity of new spring camelina varieties based on the application of mineral fertilizers and growth regulators, as well as establishing the optimal sowing method. The aim of the research was to identify the peculiarities of water consumption of spring camelina under the influence of mineral fertilizers, plant growth regulators, and sowing methods in the conditions of the Southern Steppe of Ukraine. The experiment setup, accounting, measurements, and related observations were carried out according to standard field experiment methodologies. Based on the results of three-year studies, it was established that under the influence of additional nutrition through the application of mineral fertilizers and plant growth regulators, the highest yield of spring camelina was obtained for the variety Prestizh (1.32 t/ha) and the variety Slavutych (1.40 t/ha) when grown with a row spacing of 15 cm against the background of applying mineral fertilizers at a rate of $N_{40}P_{40}K_{40}$ and spraying crops with the growth regulator Rost-concentrate at the rosette stage. Water consumption of spring camelina varieties depended on the yield level, which varied under the influence of additional nutrition. The total water consumption by the crop for the Prestizh variety (148.8–164.5 mm) and for the Slavutych variety (155.0–173.1 mm) was higher when sown with a row spacing of 15 cm compared to the corresponding 135.0–149.6 mm and 141.5–156.3 mm when sown with a row spacing of 70 cm. The highest total water consumption by the crop for the Prestizh variety (149.6 mm) and for the Slavutych variety (156.3 mm) was observed when growing spring camelina with a row spacing of 15 cm under the application of mineral fertilizers at a rate of $N_{40}P_{40}K_{40}$ combined with foliar feeding of crops using the growth regulator Rost-concentrate. Greater moisture consumption for yield formation was observed in the Slavutych variety. The most efficient use of moisture was recorded when growing spring camelina with a row spacing of 15 cm under the application of mineral fertilizers at a rate of $N_{40}P_{40}K_{40}$ combined with foliar feeding using the growth regulator Rost-concentrate, as evidenced by the lowest water consumption coefficient of 1227 m³/t for the Prestizh variety and 1222 m³/t for the Slavutych variety.

Keywords: spring camelina, variety, sowing method, mineral fertilizer, plant growth regulator, water consumption, yield

Introduction. Camelina (*Camelina sativa* (L.)) is an oilseed crop belonging to the Brassicaceae family. It has been used for centuries primarily in food production. However, this species also has numerous industrial applications. Today, camelina is becoming a promising crop due to its high oil content in seeds, with a predominance of unsaturated fatty acids, as well as a sufficient protein content in defatted meal. Its valuable agronomic and biotechnological properties make it an attractive renewable

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raw material for biofuels and biomaterials (Kagale et al., 2017; Piergiovanni et al., 2025; Yohannes et al., 2025).

Due to its high seed oil content and high oil yield per hectare, camelina can be efficiently processed into high-quality renewable fuels such as biodiesel, as well as renewable diesel and jet fuel using existing technologies. The increasing demand for its oil, meal, and other derivatives has intensified researchers' interest in this crop (Ahmad et al., 2023; Riaz et al., 2022).

It is also important to note the allelopathic and agronomic advantages of *Camelina sativa*, highlighting its potential as a sustainable and integrated pest management strategy in agriculture. *Camelina sativa* demonstrates the ability to suppress diseases, while glucosinolates exhibit fungicidal, nematocidal, and bactericidal activity. Moreover, camelina cover crops have been found to reduce root diseases and enhance the growth and yield of maize and soybean (Ghidoli et al., 2023).

The results of analyses of scientific and patent documents in recent years indicate the potential future applications of *Camelina sativa* as a crop for reclaimed lands, as a cover or companion crop, as a source of new chemical additives, as a raw material for the production of construction and packaging materials, and as a source of biochar and straw-based water filters (Sydor et al., 2022).

Scientific studies indicate that additional nutrition – namely, the application of mineral fertilizers and plant growth regulators – has a significant impact on productivity components, yield, and the competitiveness of camelina seeds (Hryhoriv et al., 2023; Hamaiunova et al., 2025).

Under the soil and climatic conditions of the Pre-Carpathian region of Ukraine, it was established that the highest yield of camelina (cv. Hirs′kyi) of 1.88 t/ha was obtained with the application of mineral fertilizers at a rate of $N_{30}P_{45}K_{45} + N_{60}$, which is 0.89 t/ha higher than in the control variant (0.99 t/ha). At the same time, the application of mineral fertilizers combined with three additional foliar feedings during the growing season increased the yield to 1.99 t/ha, which is 0.96 t/ha higher than the control (Hryhoriv et al., 2020; Hryhoriv et al., 2022).

A. M. Lyhochevor determined that under the conditions of the Western Forest-Steppe, the seed yield of spring camelina (cv. Myrazh) increased from 1.28 t/ha in the unfertilized variant to 2.44 t/ha with the application of $N_{120}P_{60}K_{120}$, i.e., by 90.1% (Lyhochevor, 2016).

According to studies conducted in south-central Chile, camelina responds positively to high nitrogen application rates, which maximize seed yield potential. The maximum seed yield of 2.39 t/ha was obtained with the application of 300 kg N/ha (Solis et al., 2013).

Water stress is the most important abiotic stress that negatively affects soil productivity and global food production. It also adversely influences the morphological, physiological, biochemical, and yield-related characteristics of *Camelina sativa*. Increasing crop productivity in general, and camelina in particular, under deficit irrigation systems is possible by improving water use efficiency (Noreen et al., 2025).

It has been established that foliar feeding of spring camelina plants with potassium at different rates improves growth, physiological and biochemical activity, as well as carotenoid content, thereby increasing crop yield under moisture deficit conditions. These rates should be considered in future efforts to enhance camelina productivity in semi-arid conditions with increased genetic diversity (Bukhari et al., 2022).

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It has been proven that seed priming of *Camelina sativa* with thiourea helps plants mitigate the negative effects of heat stress under moisture deficiency by improving physiological characteristics, resulting in a 12–15% increase in yield (Waraich et al., 2022).

The aim of our study was to determine the peculiarities of water consumption of spring camelina under the influence of mineral fertilizers, plant growth regulators, and sowing methods under the conditions of the Southern Steppe of Ukraine.

Materials and Methods. The experiment was conducted in 2023–2025 at the experimental field of the Institute of Oilseed Crops of the National Academy of Agrarian Sciences of Ukraine. Sowing of spring camelina (varieties Prestizh and Slavutych) was carried out at the optimal time (at soil temperature of 4–6 °C) with row spacing of 15 cm at a seeding rate of 5.0 million viable seeds per hectare and with row spacing of 70 cm at a seeding rate of 3.0 million viable seeds per hectare. The mineral fertilizer treatments were as follows: 1 – Control (without fertilizers); 2 – $N_{20}P_{30}$; 3 – $N_{30}P_{60}$; 4 – $N_{40}P_{40}K_{40}$. Mineral fertilizers were applied before pre-sowing cultivation. The plant growth regulator treatments were as follows: 1 – Control (spraying with water, 200 L/ha); 2 – Rost-concentrate (1.0 L/ha); 3 – Chelatin Oil Crops (1.5 L/ha); 4 – Aminostar (0.5 L/ha). Crop spraying was carried out at the rosette stage.

The establishment of the experiment, accounting, measurements, and related observations were performed according to standard field experiment methodologies (Rozhkov et al., 2016a). Soil moisture was determined by the thermostat-weight (gravimetric) method in the 0–100 cm soil layer. Soil samples were dried in a drying oven at 105 °C; sampling was carried out before sowing and before harvesting. Total water consumption was calculated using the water balance method. Analysis of variance was performed using the Microsoft Excel software package based on the methodologies described by Rozhkov A.O. et al. (Rozhkov et al., 2016b).

Results and Discussion. On average, over three years of our studies, the yield of spring camelina in the control treatment (without fertilizers) was, depending on the growth regulator application variant: 1.06–1.17 t/ha under row sowing and 0.85–0.93 t/ha under wide-row sowing for the variety Prestizh; 1.12–1.23 t/ha under row sowing and 0.90–0.99 t/ha under wide-row sowing for the variety Slavutych. At the same time, the yield increase from growth regulators amounted to, respectively: 0.04–0.11; 0.04–0.08; 0.06–0.11; 0.05–0.09 t/ha (Table 1).

Cultivation of spring camelina against the background of $N_{20}P_{30}$ provided a yield increase of: 0.02–0.04 t/ha under row sowing and 0.02–0.03 t/ha under wide-row sowing for the variety Prestizh; 0.03–0.04 t/ha under row sowing and 0.02–0.04 t/ha under wide-row sowing for the variety Slavutych. Spraying crops with growth regulators under this fertilization background was somewhat less effective, and the increase amounted to: 0.04–0.09; 0.04–0.07; 0.04–0.11; 0.03–0.07 t/ha, respectively. With fertilizer application at a rate of $N_{30}P_{60}$, the yield increase was: 0.11–0.16 t/ha under row sowing and 0.08–0.11 t/ha under wide-row sowing for the variety Prestizh; 0.10–0.14 t/ha under row sowing and 0.10–0.13 t/ha under wide-row sowing for the variety Slavutych. The increase from growth regulators decreased accordingly to: 0.03–0.06; 0.02–0.05; 0.03–0.07; 0.03–0.06 t/ha. Cultivation of spring camelina against the background of $N_{40}P_{40}K_{40}$ ensured a yield increase from mineral fertilizers of: 0.15–0.21 t/ha under row sowing and 0.03–0.16 t/ha under wide-row sowing for the variety Prestizh; 0.17–0.21 t/ha under row sowing and 0.12–0.17 t/ha under wide-row sowing for the variety *Slavutych*. Under the full fertilizer background, the increase

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from growth regulators amounted to: 0.02–0.05; 0.02–0.05; 0.03–0.07; 0.02–0.04 t/ha, respectively.

Table 1

Yield of spring camelina depending on the background of mineral fertilizers, sowing method, and application of growth regulators by varieties, t/ha (2023–2025)

Application of growth regulators (D)	Application of mineral fertilizers (B)			
	Without fertilizers	$N_{20}P_{30}$	$N_{30}P_{60}$	$N_{40}P_{40}K_{40}$
Prestizh (C)				
Row spacing 15 cm (A)				
Without drugs	1.06	1,10	1.22	1.27
Rost-concentrate	1.17	1.19	1.28	1.32
Chelatin Oil Crops	1.11	1.15	1.25	1.29
Aminostar	1.10	1.14	1.25	1.30
Row spacing 70 cm				
Without drugs	0.85	0.88	0.96	1.01
Rost-concentrate	0.93	0.95	1.01	1.06
Chelatin Oil Crops	0.89	0.92	0.98	1.04
Aminostar	0.90	0.93	0.99	1.03
Slavutych				
Row spacing 15 cm				
Without drugs	1.12	1.16	1.26	1.33
Rost-concentrate	1.23	1.27	1.33	1.40
Chelatin Oil Crops	1.18	1.21	1.30	1.37
Aminostar	1.16	1.20	1.29	1.36
Row spacing 70 cm				
Without drugs	0.90	0.94	1.03	1.07
Rost-concentrate	0.99	1.01	1.09	1.11
Chelatin Oil Crops	0.95	0.97	1.06	1.09
Aminostar	0.95	0.99	1.06	1.09
LSD_{095}, A – 0.010–0.020; B – 0.012–0.014; C – 0.010–0.014; D – 0.014–0.020; ABCD – 0.056–0.080.				

Source: developed by the author

On average over three years, the yield of spring camelina was higher when sown with a row spacing of 15 cm by 0.20–0.27 t/ha for the variety Prestizh and by 0.21–0.29 t/ha for the variety Slavutych.

The highest yields of spring camelina – 1.32 t/ha for the Prestizh variety and 1.40 t/ha for the Slavutych variety – were obtained with 15 cm row spacing under the application of mineral fertilizers at a rate of $N_{40}P_{40}K_{40}$ combined with foliar spraying using the growth regulator Rost-concentrate at the rosette stage.

In other natural and climatic zones of Ukraine, research results have confirmed the positive effect of additional nutrition on the productivity of spring camelina. Under the conditions of the Forest-Steppe, I. Yu. Rasadina studied the effect of different mineral fertilizers, methods of their soil application, and rates on the seed yield of spring camelina under standard cultivation technology. It was found that the

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application of mineral fertilizers at a rate of $N_{120}P_{60}K_{60}$ ensured the highest yield of spring camelina 2.01 t/ha which exceeded the control by 55% (Rasadina, 2015).

In the conditions of the Pre-Carpathian region, the effect of mineral fertilizers and micronutrients on the formation of spring camelina seed yield was investigated. It was established that the application of mineral fertilizers increased the yield of camelina by 56–87%, and when combined with three additional foliar feedings during the growing season, the yield increased almost fourfold (Hryhoriv et al., 2022; Hryhoriv et al., 2021).

The analysis of research results on the peculiarities of water consumption by spring camelina under the influence of mineral fertilizers and plant growth regulators with different sowing methods showed that the indicators varied depending on weather conditions during the growing seasons and yield levels. Thus, in 2023, soil moisture reserves in the 0–100 cm layer at the beginning of the growing season amounted to 311.3 mm. The total precipitation during the growing season, taking into account the utilization coefficient, was 72.4 mm. Depending on the growing conditions, soil moisture reserves at the end of the growing season were as follows: for the Prestizh variety, 177.3–197.8 mm under row sowing and 203.8–223.8 mm under wide-row sowing; for the Slavutych variety, 164.5–189.1 mm under row sowing and 201.2–220.3 mm under wide-row sowing. Higher values were observed in unfertilized treatments, while increasing fertilizer rates led to a decrease in soil moisture reserves. In treatments with growth regulators, this indicator was lower compared to the control (without growth regulators).

When growing spring camelina without fertilizers, total water consumption by the crop, depending on the variant of growth regulator application, was as follows: for the Prestizh variety, 185.9–192.9 mm under row sowing and 159.9–167.8 mm under wide-row sowing; for the Slavutych variety, 194.6–202.8 mm under row sowing and 163.4–170.6 mm under wide-row sowing. Under fertilization at $N_{20}P_{30}$, total water consumption increased to: for the Prestizh variety, 192.1–197.4 mm under row sowing and 163.2–170.7 mm under wide-row sowing; for the Slavutych variety, 201.5–208.3 mm under row sowing and 168.9–174.3 mm under wide-row sowing. Under fertilization at $N_{30}P_{60}$, it increased to: for the Prestizh variety, 196.5–202.0 mm under row sowing and 169.5–174.2 mm under wide-row sowing; for the Slavutych variety, 206.4–212.9 mm under row sowing and 173.1–177.9 mm under wide-row sowing. The highest total water consumption was recorded under fertilization at $N_{40}P_{40}K_{40}$: for the Prestizh variety, 199.9–206.4 mm under row sowing and 171.3–179.9 mm under wide-row sowing; for the Slavutych variety, 212.2–219.2 mm under row sowing and 176.0–182.5 mm under wide-row sowing. Between the varieties, higher moisture consumption for yield formation was observed in the Slavutych variety. In treatments with foliar application of growth regulators, total water consumption by the crop increased compared to the control (without spraying).

The indicators of the water consumption coefficient, on the contrary, were lower with the application of mineral fertilizers and spraying of crops with growth regulators, indicating more efficient use of moisture. The least efficient use of moisture was observed in the cultivation of spring camelina without fertilizers, as evidenced by the highest coefficient values: for the variety Prestizh – 1473–1603 m³/t under row sowing and 1613–1719 m³/t under wide-row sowing; for the variety Slavutych – 1336–1422 m³/t under row sowing and 1537–1651 m³/t under wide-row sowing. Moisture was used more efficiently in the cultivation of the Slavutych variety.

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The most efficient moisture use, with the lowest water consumption coefficient, was observed for the Prestizh variety – 1512 m³/t and for the Slavutych variety – 1484 m³/t under row sowing with the application of $N_{40}P_{40}K_{40}$ and spraying with the growth regulator Rost-concentrate.

In 2024, moisture reserves in the 0–100 cm soil layer at the beginning of the growing season amounted to 289.5 mm. The total precipitation during the growing season, taking into account the utilization coefficient, was 55.5 mm. Depending on the growing conditions, moisture reserves at the end of the growing season were: for the Prestizh variety – 170.4–185.3 mm under row sowing and 178.9–191.0 mm under wide-row sowing; for the Slavutych variety – 166.8–182.9 mm under row sowing and 172.7–185.1 mm under wide-row sowing. Higher values were observed in treatments without fertilizers, while increasing fertilizer rates led to a decrease in moisture reserves. In variants with the application of growth regulators, this indicator was lower compared to the control (without growth regulators).

When growing spring camelina without fertilizers, the total water consumption by the crop depending on the variant of growth regulator application was: for the Prestizh variety – 159.7–165.2 mm under row sowing and 154.0–160.7 mm under wide-row sowing; for the Slavutych variety – 162.1–168.3 mm under row sowing and 159.9–164.0 mm under wide-row sowing. Under $N_{20}P_{30}$ application, these values increased to: for the Prestizh variety – 162.4–167.1 mm under row sowing and 155.3–162.6 mm under wide-row sowing; for the Slavutych variety – 166.8–171.1 mm under row sowing and 162.4–165.7 mm under wide-row sowing. Under $N_{30}P_{60}$, they increased to: for the Prestizh variety – 170.0–172.5 mm under row sowing and 159.6–163.1 mm under wide-row sowing; for the Slavutych variety – 170.9–175.3 mm under row sowing and 167.8–169.9 mm under wide-row sowing. The highest total water consumption was observed under $N_{40}P_{40}K_{40}$: for the Prestizh variety – 171.3–174.6 mm under row sowing and 162.8–166.1 mm under wide-row sowing; for the Slavutych variety – 173.0–178.2 mm under row sowing and 169.8–172.3 mm under wide-row sowing. In terms of varieties, more moisture was used for yield formation in the Slavutych variety. In treatments with crop spraying using growth regulators, total water consumption increased compared to the control (without spraying).

The indicators of the water consumption coefficient, conversely, were lower with the application of mineral fertilizers and spraying of crops with growth regulators, indicating more efficient use of moisture. The least efficient use of moisture was observed in the cultivation of spring camelina without fertilizers, as evidenced by the highest coefficient values: for the Prestizh variety – 1377–1465 m³/t under row sowing and 1692–1791 m³/t under wide-row sowing; for the Slavutych variety – 1336–1422 m³/t under row sowing and 1618–1757 m³/t under wide-row sowing. Moisture was used more efficiently in the cultivation of the Slavutych variety.

The most efficient moisture use was observed for the Prestizh variety – 1293 m³/t under row sowing with the application of $N_{40}P_{40}K_{40}$ and spraying with the growth regulator Rost-concentrate, and for the Slavutych variety – 1263 m³/t under row sowing with the application of $N_{40}P_{40}K_{40}$ and spraying with the growth regulator Aminostar.

In 2025, soil moisture reserves in the 0–100 cm layer at the beginning of the growing season amounted to 199.8 mm. The total precipitation during the growing season, taking into account the utilization coefficient, was 59.6 mm. Depending on the growing conditions, soil moisture reserves at the end of the growing season were as follows: for the variety Prestizh, 146.1–158.5 mm under row sowing and 155.8–168.4

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mm under wide-row sowing; for the variety Slavutych, 137.6–151.2 mm under row sowing and 143.8–158.2 mm under wide-row sowing. Higher values were observed in the unfertilized background, while increasing fertilizer rates led to a decrease in soil moisture reserves. In variants with the application of growth regulators, this indicator was lower compared to the control (without growth regulators).

When growing spring camelina on an unfertilized background, the total water consumption by the yield, depending on the growth regulator treatment, was: for the Prestizh variety, 100.9–106.1 mm under row sowing and 91.0–95.4 mm under wide-row sowing; for the Slavutych variety, 108.2–113.2 mm under row sowing and 101.2–105.3 mm under wide-row sowing. Under cultivation with $N_{20}P_{30}$, these values increased to: for Prestizh, 103.7–107.3 mm (row) and 93.2–96.5 mm (wide-row); for Slavutych, 111.0–114.5 mm (row) and 103.4–107.7 mm (wide-row). Under $N_{30}P_{60}$, they increased to: for Prestizh, 108.5–112.6 mm (row) and 97.1–99.5 mm (wide-row); for Slavutych, 113.7–117.3 mm (row) and 109.1–113.7 mm (wide-row). The highest total water consumption was recorded under $N_{40}P_{40}K_{40}$: for Prestizh, 111.1–113.3 mm (row) and 99.3–103.6 mm (wide-row); for Slavutych, 116.6–121.8 mm (row) and 110.5–115.6 mm (wide-row). In variants with foliar application of growth regulators, total water consumption by the yield increased compared to the control (without spraying).

The water consumption coefficient, on the contrary, decreased with the application of mineral fertilizers and spraying with growth regulators, indicating more efficient water use. The least efficient water use was observed when growing spring camelina without fertilizers, as evidenced by the highest coefficient values: for Prestizh, 1063–1085 m³/t under row sowing and 1190–1199 m³/t under wide-row sowing; for Slavutych, 1078–1115 m³/t under row sowing and 1239–1281 m³/t under wide-row sowing. Under the conditions of the year, water was used more efficiently in the Prestizh variety.

The lowest water consumption coefficient for Prestizh (1004 m³/t) and for Slavutych (1015 m³/t) was achieved when growing spring camelina using row sowing on an $N_{40}P_{40}K_{40}$ background with foliar application of the growth regulator Rost-concentrate.

On average over three years of research, total water consumption by the yield for Prestizh (148.8–164.5 mm) and Slavutych (155.0–173.1 mm) was higher under sowing with 15 cm row spacing compared to 135.0–149.6 mm and 141.5–156.3 mm, respectively, under 70 cm row spacing. When cultivating the Prestizh variety, total water consumption was lower compared to Slavutych. The highest total water consumption by the yield – 149.6 mm for Prestizh and 156.3 mm for Slavutych—was observed when growing spring camelina with 15 cm row spacing on an $N_{40}P_{40}K_{40}$ fertilization background combined with foliar feeding using the growth regulator Rost-concentrate (Table 2).

At the same time, under these conditions, moisture was used most efficiently, as evidenced by the lowest water consumption coefficient of 1227 m³/t for the variety Prestizh and 1222 m³/t for the variety Slavutych.

Higher values of the water consumption coefficient were observed when growing spring camelina varieties without fertilizers under both sowing methods. The highest values were recorded for the Prestizh variety (1501–1569 m³/t) and the Slavutych variety (1465–1563 m³/t) when sown with a row spacing of 70 cm without fertilizer application.

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Table 2

Water consumption of spring rye depending on the background of mineral fertilizers, sowing method and application of growth regulators by variety (2023–2025)

Application of growth regulators	Application of mineral fertilizers							
	Without fertilizers	$N_{20}P_{30}$	$N_{30}P_{60}$	$N_{40}P_{40}K_{40}$	Without fertilizers	$N_{20}P_{30}$	$N_{30}P_{60}$	$N_{40}P_{40}K_{40}$
	Total water consumption, mm				Water consumption coefficient, m³/t			
Prestizh								
Row spacing 15 cm								
Without drugs	148.8	153.6	158.3	160.8	1384	1376	1280	1248
Rost-concentrate	154.4	157.3	162.0	164.5	1304	1302	1247	1227
Chelatin Oil Crops	152.3	155.5	160.5	162.8	1352	1336	1263	1243
Aminostar	152.0	154.2	161.1	163.4	1361	1339	1272	1240
Row spacing 70 cm								
Without drugs	135.0	137.2	142.1	144.5	1569	1540	1457	1413
Rost-concentrate	141.1	142.8	145.6	149.6	1501	1487	1419	1394
Chelatin Oil Crops	138.4	141.7	144.0	148.1	1526	1515	1447	1401
Aminostar	138.9	141.7	144.6	147.7	1531	1511	1439	1413
Slavutych								
Row spacing 15 cm								
Without drugs	155.0	159.8	163.7	167.3	1369	1355	1278	1243
Rost-concentrate	161.1	164.6	168.5	173.1	1288	1281	1252	1222
Chelatin Oil Crops	157.8	162.0	166.0	170.7	1321	1317	1262	1231
Aminostar	157.4	161.2	166.6	170.3	1346	1323	1274	1233
Row spacing 70 cm								
Without drugs	141.5	144.9	150.0	152.1	1563	1521	1443	1408
Rost-concentrate	146,0	149.2	153.4	156.3	1465	1463	1395	1395
Chelatin Oil Crops	143.9	146.7	152.2	155.0	1500	1497	1418	1403
Aminostar	144.9	147.3	152.5	154.8	1511	1478	1427	1404

Source: developed by the author

According to the results of other studies on the effect of nutrition optimization on water consumption of spring camelina plants conducted in the conditions of the Southern Steppe of Ukraine, it was found that under mineral fertilizer application, the water consumption coefficient decreased by 22.7–31.1%. In addition, the water consumption coefficient of spring camelina under the influence of biological products significantly decreased from 6835 m³/t in the control to 2261 m³/t with three-time application of Escort-Bio (Hamaiunova et al., 2019).

Conclusions. Based on the results of three-year studies, it was established that under the influence of additional nutrition provided by the application of mineral fertilizers and plant growth regulators, the highest yield of spring camelina was

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obtained: 1.32 t/ha for the variety Prestizh and 1.40 t/ha for the variety Slavutych. This was achieved when crops were sown with a row spacing of 15 cm against the background of mineral fertilizer application at a rate of $N_{40}P_{40}K_{40}$ combined with foliar spraying using the growth regulator Rost-concentrate at the rosette stage.

Water consumption of spring camelina varieties depended on the yield level, which varied under the influence of additional nutrition. Total water consumption by the crop ranged from 148.8 to 164.5 mm for the Prestizh variety and from 155.0 to 173.1 mm for the Slavutych variety, and was higher under 15 cm row spacing compared to 135.0–149.6 mm and 141.5–156.3 mm, respectively, under 70 cm row spacing.

The highest total water consumption was recorded at 149.6 mm for the Prestizh variety and 156.3 mm for the Slavutych variety when spring camelina was grown with 15 cm row spacing, with mineral fertilizer application at $N_{40}P_{40}K_{40}$ and foliar feeding using the Rost-concentrate growth regulator. Greater moisture was expended for yield formation in the Slavutych variety.

In treatments involving spraying of spring camelina crops with growth regulators, total water consumption increased compared to the control (without spraying) by 0.6–5.6 mm at 15 cm row spacing and 1.9–6.1 mm at 70 cm row spacing for the Prestizh variety, and by 1.4–6.1 mm at 15 cm and 1.8–4.5 mm at 70 cm row spacing for the Slavutych variety.

Moisture was used most efficiently when spring camelina was grown with 15 cm row spacing against the background of mineral fertilizer application at a rate of $N_{40}P_{40}K_{40}$ and foliar feeding with the Rost-concentrate growth regulator, as evidenced by the lowest water consumption coefficient: 1227 m³/t for the Prestizh variety and 1222 m³/t for the Slavutych variety.

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ОСОБЛИВОСТІ ВОДОСПОЖИВАННЯ РИЖІЮ ЯРОГО ПІД ВПЛИВОМ ДОДАТКОВОГО ЖИВЛЕННЯ ЗА РІЗНИХ СПОСОБІВ СІВБИ

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Наведені дані, актуальність яких полягає у визначенні ефективних заходів підвищення насіннєвої продуктивності нових сортів рижію ярого на основі застосування мінеральних добрив й регуляторів росту та встановлення оптимального способу сівби. Метою досліджень було встановлення особливостей водоспоживання рижію ярого під впливом мінеральних добрив, регуляторів росту рослин та способів сівби в умовах Південного Степу України. Закладання досліду, облік, вимірювання та супутні спостереження проводили за методиками польових дослідів. За результатами трирічних досліджень встановлено, що під впливом додаткового живлення за рахунок застосування мінеральних добрив та регуляторів росту рослин найбільшу врожайність рижію ярого сорту Престиж – 1,32 та сорту Славутич – 1,40 т/га забезпечило вирощування за сівби з шириною міжрядь 15 см на фоні внесення мінеральних добрив в дозі $N_{40}P_{40}K_{40}$ з обприскуванням посівів регулятором росту Рост-концентрат у фазу розетки. Водоспоживання сортів рижію ярого залежало від рівня врожайності, який змінювався під впливом додаткового живлення. Сумарні витрати води врожаєм для сорту Престиж 148,8–164,5 мм та для сорту Славутич 155,0–173,1 мм більшими були за сівби з шириною міжрядь 15 см проти відповідних 135,0–149,6 мм та 141,5–156,3 мм за сівби з шириною міжрядь 70 см. Найбільші сумарні витрати води врожаєм для сорту Престиж 149,6 мм та для сорту Славутич 156,3 мм відмічено за вирощування рижію ярого з шириною міжрядь 15 см на фоні внесення мінеральних добрив в дозі $N_{40}P_{40}K_{40}$ та позакореневим підживленням посівів регулятором росту Рост-концентрат. Більше вологи витрачено на формування врожаю сорту Славутич. Найбільш ефективно волога використовувалась за вирощування рижію ярого за ширини міжрядь 15 см на фоні внесення мінеральних добрив в дозі $N_{40}P_{40}K_{40}$ та позакореневим підживленням посівів регулятором росту Рост-концентрат, про що свідчить найменший коефіцієнт водоспоживання 1227 м^3/т для сорту Престиж та 1222 м^3/т для сорту Славутич.

Ключові слова: рижій ярий, сорт, спосіб сівби, мінеральне добриво, регулятор росту рослин, водоспоживання, врожайність

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