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Patterns of formation of morphometric traits and productivity of daikon (*Raphanus sativus* L. convar. *acanthiformis* Sazon.) under different sowing dates

Abstract. The adaptation of agrotechnologies to climate challenges and the sustainable production of functional food products determined the relevance of searching for optimal cultivation parameters for underutilised vegetable crops. The aim of the study was a comprehensive analysis of the formation of biometric and marketable characteristics of daikon radish as influenced by sowing dates to adapt production technology to the conditions of the Right-Bank Forest-Steppe of Ukraine. Field experiments (2022-2024) were conducted to study the cultivars 'Gulliver' and 'Minowase' across four sowing dates from early July to early August. For the 'Minowase' cultivar, sowing in the third decade of July resulted in the highest leaf count (20.8), rosette height (45.4 cm), and photosynthetic

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surface area (4,886 cm²), exceeding the indicators of other dates by 7.6-13.8%. The 'Gulliver' cultivar demonstrated a similar trend with maximum morphological parameters. Sowing in the first decade of July led to the lowest leaf weight in the studied cultivars, with a decrease of 7.4% and 29.9% compared to the optimal date. Root crop development correlated with the leaf rosette ($r = 0.31 - 0.90$): under the optimal sowing date, 'Minowase' formed root crops with a length of 35.4 cm and a diameter of 7.2 cm, ensuring the highest average weight of 426 g. In the 'Gulliver' cultivar, the average root crop weight across the studied sowing dates was 0.9-4.4% lower than that of 'Minowase'. Variability in root crop weight was determined by the sowing date at 44.9% ($p < .001$), while the influence of annual weather conditions (23.5%) and genotype (5.1%) was significantly lower. A moderate correlation was found between sowing dates and root crop weight ($r = 0.79-0.89$), and regression analysis confirmed a weight change of 8.82 g ('Gulliver') and 11.92 g ('Minowase') for every 10-day deviation. Sowing daikon in the third decade of July was optimal for yield stabilisation as it ensured a favourable hydrothermal regime; meanwhile, early sowing dates cause a significant reduction in the linear dimensions of root crops. The improved cultivation technology for daikon radish is recommended for industrial and small-scale producers to expand the assortment of vegetable crops and provide the market with fresh, valuable vegetable produce

Keywords: morphometric parameters; leaf area index; correlation analysis; climate change adaptation; varietal characteristics

INTRODUCTION

Global food security under the pressure of climatic and geopolitical factors requires the implementation of technologies for stabilising agricultural production. In this context, it is relevant to expand the range of vegetable crops due to daikon, which is characterised by high adaptive potential and biological value. Establishing the patterns of daikon morphogenesis at different sowing dates is the basis for the development of adaptive technologies, since optimising the growing dates allows coordinating the needs of organogenesis with hydrothermal resources, preventing premature bolting and yield quality deterioration. According to the forecasts given by A. Farah *et al.* (2025), the intensification of climate shocks could lead to a decrease in global food production by 14% by 2050. Researchers emphasise that traditional planning of the sowing campaign is losing its effectiveness, since anomalous warming destroys the usual biological rhythms of crops, requiring flexible decisions in choosing the timing of cultivation. For Ukraine, these challenges are especially acute, because, according to V. Vyshnevskyi (2025), the growth rate of the average annual temperature within the country significantly exceeds the world average. The researcher showed that the transformation of the thermal regime, which is manifested in an increase in the number of extremely hot days (over 30°C) by 3-5 times with a relatively stable level of precipitation, has led to increased aridisation of territories and the actual displacement of the boundaries of natural zones by hundreds of kilometres. In conditions of such instability, the agricultural economy, as noted by I. Fedosiy *et al.* (2026), requires a significant increase in the stability of yields of niche crops, in particular daikon, in conditions of resource scarcity. One of the most effective tools for adapting to environmental changes remains the optimisation of elements of cultivation technology. Q. Xu *et al.* (2024) argue that the choice of sowing dates is the most important among these elements. A scientifically sound sowing date allows synchronising the biological needs of the crop with the ecological resources of the territory. Also, S. Sajid & G. Hu (2022), in the study, proved that ignoring a systematic approach to planning sowing dates leads to crop losses of 30-50% and logistical failures.

The temperature regime is especially critical for daikon. Compliance with optimal sowing dates ensures the accumulation of the necessary amount of active temperatures, which is critical for the realisation of genetic potential.

J. Li *et al.* (2025) found that the temperature effect on the soil (over 30.7°C) in the early phases of development inhibits the division of xylem cells, which leads to the formation of a hollow core. Also, the deterioration of quality is often manifested in the form of internal browning, which is difficult to identify visually until the moment of consumption. Along with the temperature factor, the light regime is of critical importance. In particular, P. Chutimanukul *et al.* (2024) indicate that the regulation of the spectral composition and intensity of lighting, which directly correlate with the timing of sowing, allows for the intensification of photosynthesis and stimulation of the synthesis of secondary metabolites. This approach modulates the accumulation of ascorbic acid, soluble solids and anthocyanins, which ultimately determines the antioxidant potential of the product. At the same time, due to accelerated ontogenesis, radish reacts sharply to any moisture imbalance. In particular, M. Sultana *et al.* (2025) note that excess precipitation leads to cracking of root crops, while moisture deficiency at any stage critically inhibits growth, which determines the importance of optimising sowing dates.

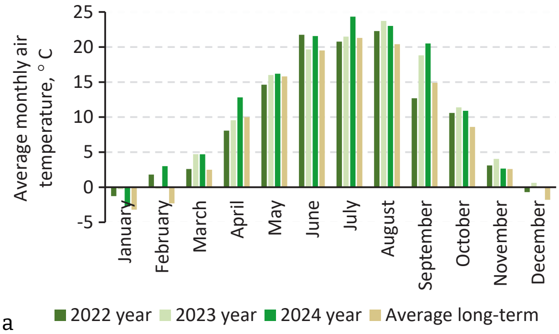
A crucial additional argument in favour of optimising the calendar sowing dates is the possibility of biological control of the number of phytophagous organisms, as pointed out by I. Fedosiy *et al.* (2025). In conformity with the conclusions of S. Rai *et al.* (2023), this agrotechnical measure allows disrupting the synchrony between vulnerable phases of plant development and peaks of pest activity, minimising the entomological load on the agrocenosis without excessive pesticide pressure on the environment. The generalisation of the results of scientific research shows that most of the works on the morphogenesis of radish and daikon are devoted either to isolated physiological reactions to temperature, or to the influence of individual elements of agricultural technology without taking into account the complex action. The issue of stabilising daikon productivity in conditions of dynamic climate change remains insufficiently studied, which causes the low efficiency of existing recommendations on sowing dates. This necessitates an urgent need for a detailed study of adaptive reactions of plants to a combination of abiotic stressors in specific soil and climatic conditions.

In this regard, the purpose of the study was to establish the patterns of the formation of the assimilation apparatus and morphometric parameters of daikon root crops depending on the hydrothermal conditions of vegetation to determine the optimal calendar period of cultivation in the conditions of the Right-Bank Forest-Steppe of Ukraine.

MATERIALS AND METHODS

The experimental study was conducted during 2022-2024 at the National University of Life and Environmental Sciences of Ukraine (NULES of Ukraine). The field experiment was conducted on the experimental plots of the NL "Fruit and Vegetable Garden" (Ukraine). The coordinates of the experimental site: 50° 22' 42.21" N, 30° 30' 05.17" E, altitude 158 m above sea level. The soils of the experimental plots were sod-podzolic on loess. The granulometric composition of the soil was light loam. The quality indicators were as follows: pH of the salt extract 6.74, organic matter (humus) 2.71%, nitrate nitrogen 6.42 mg/kg, ammonium nitrogen 11.72 mg/kg, mobile phosphorus 568.83 mg/kg, mobile potassium 152.93 mg/kg.

During 2022-2024, the average monthly air temperature in January ranged from -0.3 to -2.7°C (Fig. 1). On average, these temperatures were 1.4°C higher than the multi-year data. February turned out to be quite warm, from -0.2 to 3.0°C, exceeding the long-term data by 3.8°C. For March, the temperature regime was characterised by a distribution from 2.6 to 4.7°C, which is 1.5°C higher than the long-term data. In April, the air temperature was close to the multi-year data and exceeded its value by only 0.1°C. May was marked by a significant increase in air temperature to 14.6-16.2°C, but the average value was 0.2°C lower than the multi-year data. In June, the air temperature (19.7-21.6°C) was slightly lower than the multi-year data by 0.2°C. In July, the air temperature was almost the same as the multi-year data, with a deviation of only 0.9°C. The hottest month was August (22.3-23.7°C) and the air temperature increased relative to the multi-year data by 2.6°C. September had a rather unstable temperature regime over the years of research in the range from 12.7 to 20.5°C, but its average monthly temperature exceeded the multi-year data by 2.4°C. The average monthly temperature in October was 10.6-11.4°C, exceeding the long-term data by 2.4°C. November was marked by a decrease in air temperature to 2.7-4.1°C, which is at the level of long-term data (the deviation was 0.7°C). In December, the air temperature ranged from 0.0 to -0.7°C and was 1.8°C higher than the long-term data.



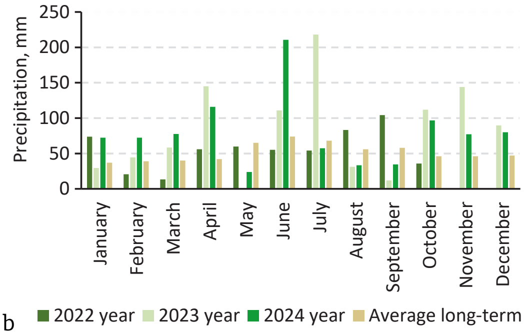


Figure 1. Monitoring of meteorological indicators: Comparative analysis of temperature (a) and precipitation (b) in 2022-2024

Source: compiled by the authors based on the conducted study

Precipitation in the winter period (December-February) was quite stable over the years, ranging from 45.8 to 58.5 mm monthly, with an average deviation from multi-year data of 12.6 mm. In contrast, the spring period (March-May) was characterised by an uneven distribution of precipitation with an average monthly indicator from 28.2 to 105.7 mm, both dry decades and periods with intense precipitation were observed. At the same time, multi-year indicators were lower in March (by 9.7 mm) and April (by 63.7 mm), and higher in May (by 36.8 mm). The autumn period (September-October) was also marked by an uneven distribution of precipitation by month, from 50.2 to 81.5 mm. Compared with long-term indicators, in October and November there was more precipitation (by 35.5 mm and 27.7 mm), and in September – less (by 7.8 mm).

Field research was conducted at the Department of Vegetable Growing and Indoor Soils of the NULES of Ukraine during 2022-2024. The scientific work programme encompassed the study of two factors influencing daikon plants: varietal characteristics (factor A) and sowing dates (factor B). The objects of the study were the varieties ‘Gulliver’ (control, Ukraine) and ‘Minowase’ (Netherlands). Sowing was carried out in four stages: in the first, second (control) and third decades of July, as well as in the first decade of August. The experiment was set up using the randomised plot method in three replications. The size of the plot for one variant of the experiment in each replication was 5 m^2. Sowing was carried out manually to a depth of 4-5 cm according to the 45×10 cm scheme. Taking into account the biological characteristics of the studied varieties, harvesting was carried out in a differentiated manner: after 50 days for ‘Gulliver’ and 60 days for ‘Minowase’. Harvesting was carried out at the BBCH 49 stage, which allowed obtaining maximum marketable indicators and preventing physiological overripeness of root crops.

For morphological descriptions, a randomised selection of 10 plants from each plot was used, which had average biometric indicators for the variant. The number of leaves and the total length of the largest leaf (including the petiole) were determined. The area of the assimilation surface was determined by contour scanning using Petiole Pro Basic software, followed by calculation of the area of leaves per 1 ha. In parallel, the morphometric parameters of root crops were recorded: the length and maximum diameter. The crop structure was assessed by separately accounting for marketable and non-marketable fractions. The average weight of marketable root crops was determined with an accuracy of 1 g. The non-marketable part of the product was subjected to a comprehensive analysis, classifying it by the reasons for rejection: disease damage, damage by pests, the presence of cracks, the tendency to bolt (premature flowering), deformation (ugliness) and undergrowth (diameter <3 cm).

Statistical processing of the results was carried out using the programmes Statistica 13.1 (StatSoft, Inc., Tulsa, OK, USA) and JASP (Version 0.95.4, JASP Team, 2025). The data distribution was checked for normality using the Shapiro-Wilk test and visual analysis of the probability plots of the residuals. Since the residuals corresponded to the law of normal distribution, a three-factor analysis of variance (Factorial ANOVA) was used to assess the influence of sowing date, variety, year of research and the interactions on morphometric indicators and average root weight. Tukey post-hoc test (HSD) was used to compare the average values and identify significant differences between the options. The strength of the influence of the studied factors was determined by the "eta-square" indicator (η^2). The relationships between the biometric parameters of the rosette and the weight of the root crop were established by calculating the Pearson correlation coefficients. Statistical significance was assessed at $p < 0.05$. Graphical interpretation of data (Box-plots and graphs) was performed in Statistica 13.1 and Excel 2024 (Microsoft Corp., Redmond, WA, USA). The study was conducted in accordance with the Convention on Biological Diversity (1992) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1976).

RESULTS AND DISCUSSION

The results of the study of morphological characteristics of the leaf rosette showed that the variety 'Minowase' was distinguished by the maximum indicators, namely: leaf length (36.9-45.4 cm), number of leaves per plant (18.5-20.8 pcs.), leaf weight (249-267 g) and leaf plate area (3,904-4,886 cm²). These values were greater than the control variety 'Gulliver' by 1.4-3.7 cm (3.9-9.4%), 2.4-3.4 pcs. (13.2-21.0%), 25-63 g (10-34%) and 560-1,133 cm² (13-41%) (Table 1).

Table 1. Morphometric indicators of daikon varieties depending on sowing dates (2022-2024)

Factor A, variety	Factor B, sowing date	Number of leaves, pcs.	Leaf rosette height, cm	Leaf weight, g	Leaf plate area, cm²	Root crop length, cm	Root crop diameter, cm	Average weight of root crop, g
'Gulliver' (c*)	First decade of July	15.4±0.83 a	35.5±1.43 a	186±3.09 c	2,771±86.0 d	25.7±0.81 a	4.8±0.15 a	371±5.78 a
	Second decade of July (c*)	16.0±0.98 ab	37.4±1.46 abc	224±9.69 a	3,387±152.7 cd	27.2±0.79 ab	5.1±0.08 ab	382±5.88 a
	Third decade of July	18.4±1.05 abcd	42.3±1.35 bcd	242±13.83 ab	4,326±250.4 ab	30.5±1.01 bc	5.6±0.13 bcd	414±7.56 bc
	First decade of August	16.5±0.84 abc	39.5±1.26 abcd	232±13.88 ab	3,526±214.8 c	28.4±0.84 ab	5.4±0.15 abc	396±8.70 ab
'Minowase'	First decade of July	18.5±0.33 abcd	36.9±1.39 ab	249±5.42 ab	3,904±83.7 a	28.0±0.65 ab	5.9±0.17 cd	374±5.84 a
	Second decade of July (c*)	19.4±0.30 bcd	40.1±1.54 abcd	253±5.59 ab	4,295±89.3 ab	28.7±0.68 ab	6.2±0.17 de	399±5.34 abc
	Third decade of July	20.8±0.66 d	45.4±1.46 d	267±3.29 ab	4,886±63.3 b	35.4±0.62 d	7.2±0.19 f	426±6.09 c
	First decade of August	19.7±1.03 cd	43.2±1.00 cd	260±3.60 b	4,492±73.8 ab	33.2±0.71 cd	6.8±0.17 ef	412±5.66 bc

Note: (c*) – control; the values given are the averages of 3 repetitions in the territory and 3 repetitions in time (2022, 2023, 2024); the error of the mean is displayed as Std.Err (±); the results of multiple comparisons of means were performed using the Tukey criterion (HSD); differences that are insignificant at p ≤ .05 are indicated by identical lowercase letters

Source: compiled by the authors based on research conducted

Significant differences were observed in the growth parameters of the leaf rosette of the varieties depending on the sowing date. Earlier sowing (the first decade of July) gave the lowest indicators of morphological characteristics in the studied varieties, namely: leaf length (35.5 cm; 36.9 cm), number of leaves per plant (15.4 pcs.; 18.5 pcs.), leaf weight (186 g; 249 g) and leaf plate area (2,771 cm^2; 3,904 cm^2) for 'Gulliver' and 'Minowase', respectively. The dynamics of changes in the height of the leaf rosette indicates that sowing in the second decade of July (control) provided significantly higher indicators (37.4 cm; 40.1 cm), which were 5.1-7.8% (or 1.9-3.1 cm) higher than the values of the previous period. The maximum height of the rosette was recorded when sowing in the third decade of July (42.3 cm; 45.4 cm), which was 4.9-5.3 cm (13.1-13.2%) higher compared to the control. The latest sowing date gave slightly lower figures (39 cm and 43.2 cm), but these figures were still 2.0-3.1 cm (5.4-7.7%) higher than the control values. In addition, an increase in the number of leaves per plant was observed compared to the control (second decade of July): by 0.3-0.5 pcs. (1.5-3.1%) for the first decade of August and by 1.5-2.4 pcs. (7.6-15.0%) for the third decade of July.

The combination of various environmental factors, primarily temperature, contributed to plant growth. Among the sowing dates, the third decade of July provided a significantly higher leaf weight (242 g; 267 g) (respectively, 'Gulliver' and 'Minowase'), which exceeded the control (second decade of July) by 14-17 g (5.7-7.7%). This indicator was followed by the first decade of August (332 g; 260 g), where the excess of the control was 7-8 g (2.8-3.4%). The increase in leaf area relative to the earliest sowing date was recorded in the second decade of July (control), where the indicators were 3,387 cm^2 and 4,295 cm^2, as well as in the third decade of July (4,326 cm^2; 4,886 cm^2) (respectively, 'Gulliver' and 'Minowase'). At the same time, in the first decade of August, a gradual decrease in this indicator was observed, which reached 3,526 cm^2 and 4,492 cm^2.

Both environmental and genetic factors are associated with the development of root crops. An increase in vegetative growth indicators (plant height, number, mass, and area of leaves) contributed to an increase in the size of root crops. The variety 'Minowase' demonstrated a higher length (29-35 cm) and diameter (5.9-7.2 cm) of the root crop compared to the variety 'Gulliver' (control) at all sowing dates, exceeding it by 2-5 cm (5.5-16.9%) and 1.1-1.6 cm (21.6-28.6%), respectively. Among the sowing dates, the maximum length (30.5; 35.4 cm) and diameter (5.6; 7.2 cm) of the root crop (respectively, 'Gulliver' and 'Minowase') were recorded during sowing in the third decade of July. This was followed by the first decade of August (length: 28.4; 33.2 cm; diameter: 5.4; 6.8 cm) and the second decade of July (control) (length: 27.2; 28.7 cm; diameter: 5.1; 6.8 cm). While during sowing in the earliest term (the first decade of July), the smallest values of the length and diameter of the root crop were noted. The average weight of daikon roots was significantly influenced by the sowing dates, varieties, and the interaction. Regardless of the sowing dates, the 'Minowase' variety had a higher average root weight (403 g), while the 'Gulliver' (control) variety had a lower average weight by 12 g or 3.1%. When the 'Minowase' variety was sown in the first decade of July, the minimum deviation in the weight of the root crops was recorded in the experimental plots (3 g or 0.8%) compared to the control ('Gulliver' variety), but the weight of the root crops (399-426 g) differed significantly in the sowing options from the second decade of July to the first decade of August – by 12-17 g or 2.9-4.5%.

Among the sowing dates of the 'Gulliver' (control) variety, the sowing option in the third decade of July was noted, which had a significantly higher weight of the root crop (414 g) compared to the control (second decade of July). Next came the variant of the first decade of August – 396 g, while the first decade of July had the lowest root weight (371 g). The deviation of the indicator relative to the control for these variants was as follows: 32 g (8.4%), 14 g (3.7%) and – 11 g (-2.9%), respectively. Also, among the variants of sowing dates, the variety 'Minowase' in the third decade of July showed the maximum indicator of root weight (426 g), which was significantly greater (by 27 g or 6.8%) than in the control variant (second decade of July). An increase in root weight (up to 412 g) relative to the control (second decade of July) (by 13 g or 3.3%) was also observed when sowing in the first decade of August. The lowest root weight (374 g) was recorded in the first decade of July, which is 25 g or 6.3% less than the control (second decade of July). Statistical analysis confirmed that the average weight of the root crop is significantly influenced by all three main factors: sowing date, year of study and variety (Table 2). The most important among these factors was sowing date, which determines 44.9% of all changes in root crop weight ($p < .001$). The influence of weather conditions of the year is 23.5% ($p < .001$), while the characteristics of the variety have a much smaller weight – only 5.1% ($p < .001$).

Table 2. Indicators of significance and influence of factors on the formation of root crop mass (2022-2024)

Cases	Sum of Squares	df	Mean Square	F	p	η^2	95% CI for η^2	
							Lower	Upper
Sowing period	21,894.6	3	7,298.19	38.984	<.001	0.449	0.220	0.596
Veriate	2,476.9	1	2,476.91	13.231	<.001	0.051	0.000	0.211
Year	11,461.3	2	5,730.63	30.610	<.001	0.235	0.045	0.414
Sowing period ∗ Veriate	474.2	3	158.06	0.844	.476	0.010	0.000	0.048
Sowing period ∗ Year	2,318.2	6	386.37	2.064	.075	0.048	0.000	0.086
Veriate ∗ Year	735.4	2	367.70	1.964	.151	0.015	0.000	0.111
Residuals	8,986.2	48	187.21					
Sowing period ∗ Veriate ∗ Year	429.9	6	71.65	0.383	.886	0.009	0.000	0.000

Note: type III sum of squares
Source: compiled by the authors based on the conducted study

A critical feature is that no interaction between the factors produced a statistically confirmed result. The interaction of sowing date with the year of the study explains 4.8% of the variations ($p = .075$), and the effect of variety in combination with year is 1.5% ($p = .151$). The combination of variety with sowing date has an effect of 1% ($p = .476$), and the simultaneous interaction of all three factors is only 0.9% ($p = .886$). Since in all these cases the significance indicator exceeds the .05 threshold, this means that the effect of sowing date and variety is stable and does not significantly depend on the year of the study or the chosen combination of conditions.

The high reliability of these data is confirmed by the calculations of confidence intervals. In particular, for the factors of sowing date and year of the study, the limits of probable error are far from zero (the lower limit is 22% for sowing and 4.5% for year). This indicates that the influence of these factors is guaranteed. For the variety, the lower limit of the interval is 0.0%, which indicates a less stable nature of this factor. The variety 'Minowase' in the variants of the first-third decades of July demonstrates a distribution of the number of leaves that mimics a close to normal one, since its mean and median are very close, and there are no outliers (Fig. 2). In contrast, the distribution of the variety 'Gulliver' (control) in the variants of the third decade of July and the first decade of August has a similar characteristic. In the sowing terms of the first-second decades of July for the variety 'Gulliver' (control) and the first decade of August for the variety 'Minowase', the measures of central tendencies are in different places, so the distribution is not normal, and a right-sided asymmetry is observed (the mean value is noticeably higher than the median).

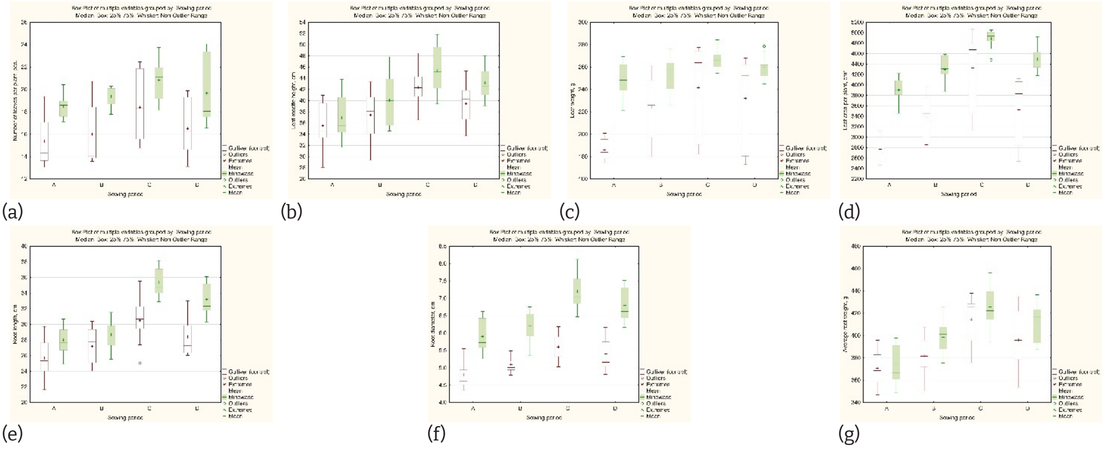


Figure 2. The influence of sowing dates on the variability of morphometric and productive indicators of daikon varieties (Box-plot)

Note: sowing dates: A – 1st decade of July; B – 2nd decade of July (control); C – 3rd decade of July; D – 1st decade of August. The studied indicators: (a) – number of leaves, pcs.; (b) – height of the leaf rosette, cm; (c) – leaf weight, g; (d) – leaf plate area, cm^2; (e) – root length, cm; (f) – root diameter, cm; (g) – average root weight, g

Source: compiled by the authors based on the conducted research

The height of the leaf rosette for the variety 'Minowase' in the second decade of July and for 'Gulliver' in the third decade of July demonstrates a normal distribution. Also, a distribution close to normal was noted in the variant 'Minowase' in the third decade of July. The median (the line inside the rectangle) is located closer to the lower (Q1) boundary of the box (the first quartile), which indicates a right-sided asymmetry for the variety 'Gulliver' (control) in the variants of the first decade of July and the first decade of August. In contrast, a left-sided asymmetry was noted for the variety 'Gulliver' (control) in the second decade of July and the first decade of August. In all cases, there are no outliers. In the variant of the variety 'Minowase' in the first decade of July, the distribution of leaf weight indicates normality. The mean and median for the variety 'Gulliver' (control) of the first-second decades of July and the variety 'Minowase' of the third decade of July are almost at the same point, but do not pass the normality test. In the case of the variety 'Minowase' of the third decade of July, an outlier was recorded beyond the upper limit (upper whisker). Left-sided asymmetry can be clearly observed in the variants of the variety 'Minowase' of the second decade of July and the variety 'Gulliver' (control) of the third decade of July and the first decade of August, and right-sided asymmetry in 'Minowase' of the third decade of July. The mean and median of the leaf area index for sowing the variety 'Gulliver' (control) of the first-second decades of July and the variety 'Minowase' of the first-second decades of July and the first decade of August are almost at the same point, but not quite, while in other variants, the mean and median are located at different points of the distribution. One case of deviation (beyond the lower limit of the diagram) was detected for the variety 'Minowase' sown in the third decade of July.

The root length indicator demonstrates a non-normal distribution; one case of outlier beyond the lower limit of the diagram was recorded ('Gulliver' (control), sown in the third decade of July). The median shift to the upper part of the rectangle is observed only for the variety 'Gulliver' (control) sown in the second-third decades of July and for 'Minowase' sown in the second decade of July. The diagram demonstrates a distribution of root diameter that is not normal, although no outliers (or anomalous values) were detected. In most cases, a right-sided asymmetry is observed; only in the variants of the second decade of July ('Minowase') and the third decade of July ('Gulliver' (control)) was a left-sided asymmetry recorded. This is confirmed by the fact that the mean value is less than the median. The initial data of the average weight of the root crop do not contain any outliers. The diagram indicates the normality of the distribution only for the variants of the second decade of July ('Gulliver' (control)) and the first decade of August ('Minowase'), since the mean and median are at the same point (or are almost equal). Right-sided asymmetry is predominant, which is confirmed by the fact that the mean is greater than the median. Left-sided asymmetry was established exclusively in the variants of the second decade of July, the first decade of August ('Minowase') and the third decade of July ('Gulliver' (control)).

A positive correlation was found between the morphological indicators of daikon (Table 3). In the Gulliver variety (control), strong correlations (r = 0.67-0.89) were observed between leaf area and leaf weight (r = 0.89), between rosette height and root length (r = 0.80), number of leaves and rosette height (r = 0.80), leaf area and average root weight (r = 0.79), leaf weight and rosette height (r = 0.74), leaf weight and average root weight (r = 0.73), number of leaves and leaf weight (r = 0.70), as well as between number of leaves and leaf area (r = 0.68) and number of leaves and root length (r = 0.67). Average correlations (r = 0.36-0.63) were recorded between the sowing period and most morphological traits: root diameter (r = 0.52), average root weight (r = 0.41), leaf weight (r = 0.41), leaf area (r = 0.41), root length (r = 0.40) and rosette height (r = 0.36). The average also correlations include the relationships between root length and diameter (r = 0.63), number of leaves and average root weight (r = 0.61), rosette height and average root weight (r = 0.59), number of leaves and root diameter (r = 0.56) and rosette height and root diameter (r = 0.50).

Table 3. Correlation matrix of morphological indicators in daikon varieties (2022-2024)

Varieties	Variable	SD	LW	LA	NL	LRH	RL	RD	ARW
'Gulliver' (control)	SD	–							
	LW	0.407*	–						
	LA	0.412*	0.892***	–					
	NL	0.183	0.704***	0.680***	–				
	LRH	0.364*	0.736***	0.741***	0.798***	–			
	RL	0.399*	0.437**	0.523**	0.667***	0.802***	–		
	RD	0.518**	0.311	0.408*	0.557***	0.496**	0.631***	–	
	ARW	0.409*	0.734***	0.791***	0.614***	0.592***	0.487**	0.396*	–
'Minowase'	SD	–							
	LW	0.340*	–						
	LA	0.601***	0.750***	–					
	NL	0.256	0.594***	0.633***	–				
	LRH	0.512**	0.785***	0.807***	0.747***	–			
	RL	0.668***	0.580***	0.783***	0.367*	0.729***	–		
	RD	0.560***	0.581***	0.738***	0.400*	0.781***	0.897***	–	
	ARW	0.576***	0.413*	0.658***	0.365*	0.501**	0.652***	0.604***	–

Note: SD – sowing date; LW – leaf weight; LA – leaf area per plant; NL – number of leaves per plant; LRH – leaf rosette height; RL – root length; RD – root diameter; ARW – average root weight. Correlation is significant at the * p<.05, ** p<.01, *** p<.001 level; n=36

Source: compiled by the authors based on the conducted study

The 'Minowase' variety is characterised by even higher consistency of morphological traits, as most of the relationships are strong (r=0.66-0.90): between root length and diameter (r = 0.90), leaf area and rosette height (r = 0.81), rosette height and root diameter (r = 0.78), leaf weight and rosette height (r = 0.79), leaf area and length (r = 0.78), leaf area and root diameter (r = 0.74), rosette height and number of leaves (r = 0.75), leaf area and leaf weight (r = 0.75), leaf area and average root weight (r = 0.66), as well as between the sowing period and root length (r = 0.67). Moderate relationships were noted between length and average root weight (r = 0.65), number of leaves and leaf area (r = 0.63), leaf weight and number of leaves (r = 0.59), between diameter and average root weight (r = 0.60), leaf weight and root length (r = 0.58), leaf weight and diameter (r = 0.58), as well as between the sowing period and the remaining morphological indicators – leaf area (r = 0.60), rosette height (r = 0.51), diameter (r = 0.56) and average root weight (r = 0.58). Thus, the presence of a correlation between the indicators of the vegetative part of the plant (leaf area, leaf weight, rosette height) and the parameters of the root crop (diameter, length, weight) confirms the key role of leaves in ensuring the productivity of daikon, since the intensive development of the assimilation apparatus directly affects the accumulation of biomass and the formation of the marketable part of the plant. Statistical processing of experimental data and the graphic representation in Figure 3 allowed establishing that an increase in the duration of the growing season by 10 days for the variety 'Gulliver' (control) contributed to an increase in the following indicators: the number of leaves – by 0.44 pcs.; the height of the leaf rosette – by 1.41 cm; the weight of the leaves – by 12.79 g; the area of the leaf plate – by 262.44 cm²; the length of the root crop – by 1.00 cm; root diameter by 0.21 cm, and average root weight by 8.82 g. In turn, for the variety 'Minowase', shifting the sowing dates by 10 days increased the number of leaves by 0.42 pcs.; the height of the leaf rosette by 2.13 cm; the weight of the leaves by 4.18 g; the area of the leaf plate by 209.07 cm²; the length of the root by 2.01 cm; the diameter of the root by 0.33 cm, and the average weight of the root by 11.92 g.

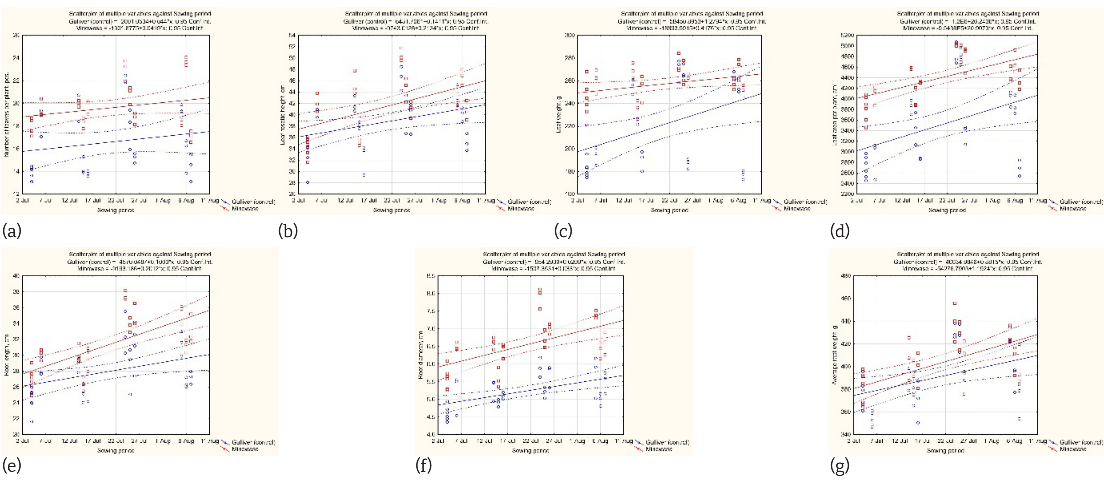


Figure 3. Dependence of morphometric and productive indicators of daikon varieties on sowing dates, approximated by linear regression

Note: sowing dates: A – 1st decade of July; B – 2nd decade of July (control); C – 3rd decade of July; D – 1st decade of August. Investigated indicators: (a) – number of leaves, pcs.; (b) – height of leaf rosette, cm; (c) – leaf weight, g; (d) – leaf plate area, cm²; (e) – root length, cm; (f) – root diameter, cm; (g) – average root weight, g

Source: compiled by the authors based on research conducted

This confirms that a developed assimilation apparatus is a key resource for biomass accumulation, and sowing in the third decade of July and the first decade of August stimulate its intensive formation. It has been statistically confirmed that the weight of the root crop directly depends on its length and diameter: the larger these parameters, the higher the total mass of the plant. It has been established that the yield of daikon depends on hydrothermal conditions during critical phases of vegetation. Sowing in the third decade of July is a defining term for the studied area, as it allows for the maximum realisation of the biological potential of the crop.

This correlates with international trends in the search for the most profitable periods of production. In particular, A. Sharma *et al.* (2023) using the example of India proved that growing radish in the off-season is more economically profitable due to the higher market value than in the main period. This statement is based on a comprehensive analysis of morphometry, correlations and statistical distribution of traits, which is consistent with and significantly complements the results of world scientific practice. During the experiment, a significant amplitude of variability in leaf rosette growth depending on the sowing date was recorded. The lowest indicators were observed with early sowing (first decade of July), while a shift to the third decade of July led to an increase in rosette height to 42.3-45.4 cm (+13.1-13.2% compared to the control). This phenomenon finds a deep physiological justification in the works of S. Oh *et al.* (2022), where it was established that temperature is a limiting factor in radish morphogenesis: at indicators above 29/23°C (day/night), inhibition of root growth and abnormal elongation of the hypocotyl are observed. The low productivity of crops in the first decade of July (root weight 371-374 g) in this study is explained precisely by the coincidence of the initial phases of development with the July temperature maximum, which exceeds the physiological optimum (19-24°C).

The revealed pattern between sowing dates and productivity contrasts with the data published by S. Khan *et al.* (2022) and S. Parajuli & P. Dhital (2023). If in the subtropical zones of Pakistan and Nepal, "early" crops (October-November) demonstrate better results (leaf length 22.61 cm) than late ones, due to the coincidence with the beginning of the cool season, then in temperate climates, "early" crops (early July) fall into the peak of heat, which creates stressful conditions. This is consistent with the data of N. Khusanov *et al.* (2024), which indicate a temperature threshold for germination of 30°C. In addition to temperature, the light regime is an important factor. The results of M. Hudu *et al.* (2025) in Nigeria showed that in the wet season (longer daylight hours, better moisture) a more powerful rosette is formed. This explains the slight decrease in indicators in the sowing option in the first decade of August (leaf weight decreased by 7-11 g compared to the third decade of July), since the reduction in daylight hours in August limits the photosynthetic potential of plants. This effect is even more pronounced in the study of P. Cottney *et al.* (2022) in Ireland, where late sowing (September) led to a critical drop in biomass (from 1,200 to <100 kg/ha) due to a deficiency of solar radiation. Also, the decrease in yield with early sowing correlates with biotic pressure, since S. Patra *et al.* (2024) established a direct relationship between the increase in temperature and the number of pests, which in the first decade of July led to damage to the assimilation apparatus.

It was found that the variety 'Minowase' demonstrated not only higher productivity (root weight up to 426 g, length up to 35 cm), but also higher ecological plasticity compared to the variety 'Gulliver'. This is confirmed by the analysis of the data distribution, where the variety 'Minowase' in the variants of the first-third decades of July demonstrated a distribution close to normal (mean ≈ median), without significant outliers, which indicates genetic stability. In contrast, the variety 'Gulliver' more often demonstrated distribution asymmetry, responding to stress by deviating from the mean values. This confirms the classification of S. Kumar *et al.* (2023) and A. Dhand & N. Garg (2023), who characterise Asian variety types (to which 'Minowase' belongs) as more tolerant to summer temperatures. In contrast to the data of S. Ali *et al.* (2023), where the plant height reached only 25.84 cm, the variety 'Minowase' under experimental conditions formed a rosette 45.4 cm high, which indicates better adaptation of this genotype to the long-day conditions of the Forest-Steppe.

Extremely close correlations were also found between the mass of the root crop and the indicators of the leaf apparatus, which are stronger than those described in the modern literature. In particular, the correlation between the length and diameter of the root crop in the variety 'Minowase' was r = 0.90 (versus r = 0.60), and the relationship between the mass of the leaves and the mass of the root crop in the variety 'Gulliver' was r = 0.89 (versus r = 0.41) (Esho & Jasim, 2022; Luitel *et al.*, 2024). Such high determination allows stating that in the conditions of the research region, the limiting factor in yield is precisely the development of the leaf area. This is confirmed by regression analysis, according to which the extension of the vegetation period by 10 days provides an increase in leaf area by 209-262 cm^2, which directly transforms into an increase in root weight by 8.8-11.9 g. These calculations are consistent with the data of N. Pokharel *et al.* (2023), who proved that maximising the weight of the root crop is impossible without achieving optimal parameters of the photosynthetic surface. Thus, the obtained data confirm that sowing the 'Minowase' variety in the third decade of July is a strategically important condition for its adaptation to specific soil and climatic conditions and the realisation of yield potential, since it is this term that ensures balanced growth and development, high genetic stability and the most efficient use of available agroclimatic resources.

CONCLUSIONS

Comprehensive studies of the growth and development of daikon in the conditions of the Right-Bank Forest-Steppe of Ukraine have allowed establishing a clear relationship between the sowing dates and the realisation of the biological potential of varieties. It has been confirmed that the meteorological conditions of the second half of summer are decisive for the formation of both the assimilation apparatus and the productive part of the plant. The most intensive growth of vegetative mass occurs when sowing in the third decade of July. It is this period that provides the optimal combination of temperature regime and daylight hours, which allows the 'Minowase' variety to form a powerful rosette with a leaf area of 4,886 cm^2, which is 13.8% higher than the control sowing date. Early July sowing causes premature ageing of leaves and inhibition of photosynthetic processes due to excessive solar insolation. The sowing date is a determining factor in the productivity of root crops, as evidenced by the obtained correlation coefficients at the level of 0.79-0.89. The highest average root weight (414-426 g) in the studied varieties is provided by sowing in the third decade of July. When shifting the sowing dates to August, there is a tendency to a slight decrease in the mass of root crops. The variety 'Minowase' demonstrated better adaptive ability to the conditions of the region, forming root crops with higher linear parameters (by 5.5-16.9% length; by 21.6-28.6% diameter) compared to the control variety. Analysis of morphometric indicators confirmed the stable superiority of the variety 'Minowase' in all the studied parameters.

The results of the analysis of variance indicate that the determining factor in the formation of the mass of root crops is the sowing date, the share of influence of which is 44.9% ($p < .001$). Weather conditions of the year have a significant, but half as much influence (23.5%). Varietal characteristics, although significant, play a secondary role (5.1%). The absence of significant interaction between factors ($p > .05$) confirms the independence of the action of agrotechnical techniques from the genotype and climatic fluctuations of the year. Further scientific work in this direction should be focused on studying the influence of mineral nutrition and irrigation systems in combination with optimised sowing dates. An important aspect is also the study of keeping quality and biochemical composition of root crops depending on the time of harvest, which will allow developing comprehensive recommendations for extending the shelf life of fresh daikon products in the autumn-winter period.

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CONFLICT OF INTEREST

None.

REFERENCES

[1] Ali, S., Zahid, Z.H., Siddike, N., Bappi, Z.H., Payel, N.A., Islam, T., Rahman, J., & Mohsin, G. (2023). Effect of different levels of organic fertilizer on growth, yield and economic benefits of radish (*Raphanus sativus* L.). *Journal of Bioscience and Agriculture Research*, 30(2), 2533-2540. doi: 10.18801/jbar.300223.306.

[2] Chutimanukul, P., Piew-ondee, P., Dangsamer, T., Thongtip, A., Janta, S., Wanichananan, P., Thepsilvisut, O., Ehara, H., & Chutimanukul, P. (2024). Effects of light spectra on growth, physiological responses, and antioxidant capacity in five radish varieties in an indoor vertical farming system. *Horticulturae*, 10(10), article number 1059. doi: 10.3390/horticulturae10101059.

[3] Convention on Biological Diversity. (1992, June). Retrieved from https://surl.lu/evnhtq.

[4] Convention on International Trade in Endangered Species of Wild Fauna and Flora. (1976, March). Retrieved from https://surl.lu/neikla.

[5] Cottney, P., Black, L., Williams, P., & White, E. (2022). How cover crop sowing date impacts upon their growth, nutrient assimilation and the yield of the subsequent commercial crop. *Agronomy*, 12(2), article number 369. doi: 10.3390/agronomy12020369.

[6] Dhand, A., & Garg, N. (2023). Genotype × environment interaction using AMMI and MTSI analysis for growth and yield attributes of radish (*Raphanus sativus* L.) under high temperature stress conditions of north Indian plains. *Scientia Horticulturae*, 313, article number 111880. doi: 10.1016/j.scienta.2023.111880.

[7] Esho, K.B., & Jasim, E.A.-A. (2022). Correlation and path coefficient analysis and regression in radish (*Raphanus sativus* L.). *International Journal of Agricultural and Statistical Sciences*, 18(1), 1199-1205.

[8] Farah, A.A., Mohamed, M.A., Musse, O.S.H., & Nor, B.A. (2025). The multifaceted impact of climate change on agricultural productivity: A systematic literature review of Scopus-indexed studies (2015-2024). *Discover Sustainability*, 6, article number 397. doi: 10.1007/s43621-025-01229-2.

[9] Fedosiy, I., Rucins, A., Aboltins, A., Viesturs, D., Bobos, I., Komar, O., Zavadska, O., Retman, M., Havrys, I., & Siedova, O. (2026). Evaluation of yield potential and quality of daikon (*Raphanus sativus* L. *convar. acanthiformis* Sazon.) cultivars under different sowing dates. *Agronomy*, 16(3), article number 282. doi: 10.3390/agronomy16030282.

[10] Fedosiy, I.O., Bobos, I.M., & Komar, O.O. (2025). Varietal and agrotechnical aspects of quality control of daikon root crops. *Bulletin of Uman National University of Horticulture*, 2, 37-45. doi: 10.32782/2310-0478-2025-2-38-45.

[11] Hudu, M., *et al.* (2025). Effects of spacing and planting method on growth and yield of radish (*Raphanus sativus* L.) under contrasting conditions of dry and wet seasons. *Annual Research & Review in Biology*, 40(2), 62-69. doi: 10.9734/arrb/2025/v40i22201.

[12] Khan, S.M., Ali, A., Hussain, I., Saeed, M., Hussain, I., Ali, S., Khan, S.A., Ali, N., Khan, M.A., & Khan, I.A. (2022). Evaluation of radish genotypes with special study on sowing geometry at agricultural research institute, Tarnab, Peshawar. *Horticulture International Journal*, 6(1), 1-4. doi: 10.15406/hij.2022.06.00233.

[13] Khusanov, N., Boboyev, S., Razzakova, S., Shoira, N., Juliyev, M., & Turabayev, A. (2024). *Raphanus sativus* L. and its determination of planting dates based on seed germination in different ecological environments of Uzbekistan. *E3S Web of Conferences*, 497, article number 03029. doi: 10.1051/e3sconf/202449703029.

[14] Kumar, S., Gulzar, M., Rajbhar, P., & Rajbhar, R. (2023). Advances in breeding of radish. In G. Mishra, P.K. Singh, P. Pandey & A. Sohi (Eds.), *Breeding approaches in vegetable crops* (pp. 140-152). Lucknow: Golden Leaf Publishers.

[15] Li, J., Jia, J., Qin, Z., Liu, X., & Xin, M. (2025). Advances on the formation and detection of hollow heart in vegetable crops. *Vegetable Research*, 5, article number e005. doi: 10.48130/vegres-0024-0041.
[16] Luitel, B.P., Bhusal, Y., & Bhandari, B.B. (2024). Evaluation of radish (*Raphanus sativus* L.) varieties in different sowing dates for off-season production at Dailekh. *The Journal of Agriculture and Environment*, 25, 117-125.
[17] Oh, S.Y., Moon, K.H., Shin, M., Lee, S.E., & Koh, S.C. (2022). Growth and productivity of radish (*Raphanus sativus* var. *hortensis*) under different day/night temperatures. *Horticultural Science and Technology*, 40(2), 168-178. doi: 10.7235/HORT.20220016.
[18] Parajuli, S., & Dhital, P.R. (2023). Effect of plant spacing and sowing dates on the growth and yield of radish (*Raphanus sativus*) in Rupandehi district, Nepal. *Archives of Agriculture and Environmental Science*, 8(4), 579-584. doi: 10.26832/24566632.2023.0804018.
[19] Patra, S., *et al.* (2024). Impact of weather variables on radish insect pests in the eastern Himalayas and organic management strategies. *Sustainability*, 16(7), article number 2946. doi: 10.3390/su16072946.
[20] Pokharel, N.P., Gurung, P., Kharel, G.P., Parajuli, A., & Khanal, S. (2023). Effect of different organic manures on growth, yield, and quality of late season radish (*Raphanus sativus*) in Paklihawa, Rupandehi, Nepal. *Research Square*, preprint article. doi: 10.21203/rs.3.rs-3662769/v1.
[21] Rai, S., Kuotsu, K., Majumder, S., Pathak, M., Patra, S., Sangma, R.H.C., Kadam, V., & Devi, R.K.T. (2023). Incidence of insect pests on radish with different dates of sowing in Meghalaya. *Indian Journal of Hill Farming*, 36(2), 127-131. doi: 10.56678.
[22] Sajid, S.S., & Hu, G. (2022). Optimizing crop planting schedule considering planting window and storage capacity. *Frontiers in Plant Science*, 13, article number 762446. doi: 10.3389/fpls.2022.762446.
[23] Sharma, A., Lata, H., Sood, P., Thakur, A., Sharma, K.C., & Sharma, P. (2023). Off-season vegetable growing for nutrition and entrepreneurship. In B. Singh & P. Kalia (Eds.), *Vegetables for nutrition and entrepreneurship* (pp. 279-296). Singapore: Springer. doi: 10.1007/978-981-19-9016-8_13.
[24] Sultana, M., Sultana, N., Haque, A., Akter, A., Mahbub, F., & Hossain, F. (2025). Strategic optimization of irrigation and nitrogen levels to maximize growth and yield of radish (*Raphanus sativus* L.). *Journal of Agroforestry and Environment*, 18(2), 252-257. doi: 10.55706/jae1844.
[25] Vyshnevskyi, V.I. (2025). Climate change in Ukraine and its consequences. *Journal of Landscape Ecology*, 18(4), 150-174. doi: 10.2478/jlecol-2025-0032.
[26] Xu, Q., *et al.* (2024). Assessing climate change impacts on crop yields and exploring adaptation strategies in Northeast China. *Earth's Future*, 12(4), article number e2023EF004063. doi: 10.1029/2023EF004063.

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Закономірності формування морфометричних ознак та продуктивності дайкону (*Raphanus sativus* L. *convar. acanthiformis* Sazon.) за різних термінів сівби

Анотація. Адаптація агротехнологій до кліматичних викликів та стале виробництво функціональних продуктів визначили актуальність пошуку оптимальних параметрів вирощування малопоширених овочевих культур. Мета дослідження полягала у комплексному аналізі формування біометричних і товарних характеристик дайкону під впливом термінів сівби для адаптації технології виробництва в умовах Правобережного Лісостепу України. Польовий експеримент (2022-2024 роки) проведено із вивченням сортів ‘Гулівер’ і ‘Міновасі’ за чотирьох термінів сівби від початку липня до початку серпня. У сорту ‘Міновасі’ за сівби у третій декаді липня зафіксовано найбільшу кількість листків (20,8 шт.), висоту розетки (45,4 см) та площу фотосинтетичної поверхні (4886 см^2), що на 7,6-13,8 % перевищило показники інших термінів. Сорт ‘Гулівер’ продемонстрував аналогічну тенденцію з максимальними морфологічними показниками. Сівба у першій декаді липня призвела до формування найменшої ваги листків у досліджуваних сортах із зниженням на 7,4 % та 29,9 % порівняно з оптимальним терміном. Розвиток коренеплодів корелював із розеткою листків ($r = 0,31 - 0,90$): сорт ‘Міновасі’ за сівби в оптимальний термін формував коренеплоди довжиною 35,4 см та діаметром 7,2 см, що забезпечило найбільшу середню масу 426 г. У сорту ‘Гулівер’ середня маса коренеплоду за досліджуваних термінів сівби була на 0,9-4,4 % меншою ніж у ‘Міновасі’. Варіабельність маси коренеплоду на 44,9 % ($p < 0,001$) зумовлювалась саме терміном сівби, тоді як вплив погодних умов року (23,5 %) та генотипу (5,1 %) був значно меншим. Виявлено середній кореляційний зв'язок між термінами сівби та масою коренеплоду (r = 0,79 - 0,89), а регресійний аналіз підтвердив зміну маси на 8,82 г (сорт 'Гулівер') та 11,92 г ('Міновасі') на кожні 10 діб відхилення. Сівба дайкону в третій декаді липня була оптимальною для стабілізації врожайності, оскільки забезпечила сприятливий гідротермічний режим; водночас ранні терміни сівби зумовили суттєве зменшення лінійних розмірів коренеплодів. Удосконалена технологія вирощування редьки дайкону рекомендується для товаровиробників промислового і присадибного сектору для розширення асортименту овочевих культур і забезпечення ринку свіжою цінною овочевою продукцією

Ключові слова: морфометричні параметри; індекс листкової поверхні; кореляційний аналіз; адаптація до змін клімату; сортові особливості