



THE INFLUENCE OF SOWING DATES ON THE YIELD OF ROMAINE (LACTUCA SATIVA VAR. LONGIFOLIA) UNDER THE CONDITIONS OF UZBEKISTAN

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<https://doi.org/10.5281/zenodo.17897560>

ARTICLE INFO

Received: 09th December 2025

Accepted: 10th December 2025

Online: 11th December 2025

KEYWORDS

variety, sowing date, plant weight, romaine lettuce, leaf lettuce, vegetation period duration, yield.

ABSTRACT

Research was conducted at the Scientific Research Institute of Vegetable, Melon Crops and Potato (Uzbekistan) in 2024–2025 to study the effect of sowing dates on the productivity of romaine lettuce (*Lactuca sativa* var. *longifolia*) varieties in comparison with leaf lettuce (*Lactuca sativa* L.). The experiment included five sowing dates: February 20, March 1 (control), March 10, March 20, and March 30, with a planting scheme of 70×30 cm. It was established that the onset of the technical ripeness phase depends on sowing dates and accelerates when shifting from early to later dates in the spring period. To obtain early bunched produce, sowing on February 20 provided a yield of leaf lettuce of 1.37 kg/m² and romaine varieties of 2.19–2.43 kg/m². Compared to the control (March 1), maximum yield was noted for sowing on March 10: for leaf lettuce variety Kok shokh – 1.82 kg/m², for romaine varieties Korolevskiy pir and Quintus – 2.89–3.15 kg/m², which enhances their agricultural value for cultivation..

Introduction

Lettuce (*Lactuca sativa* L.) is a widely distributed and valuable vegetable crop in many countries, where cultivation technologies for varieties of different types have been developed. The most important agrotechnical factor determining the production of high-quality lettuce is the timing of seed sowing for seedling cultivation and subsequent planting in open ground conditions.

The effect of lettuce sowing dates in open and protected ground has been studied by a number of researchers. It has been established that climatic and soil conditions, varietal biological characteristics, cultivation agrotechniques, and other factors significantly influence the duration of maturation and economically valuable traits (Bobkova O.N., 2018).

Sowing dates affect a complex of economically useful traits. For example, when grown in open ground with six sowing dates from January to March for the romaine variety 'Galandier', maturation occurred 65–75 days after sowing (website). In studies by Turdiyeva F.T. (2023),

planting seedlings of various lettuce varieties on March 1 and 10 resulted in plants forming higher indicators of height and rosette diameter, as well as an improved biochemical composition compared to the control (planting on March 20). Kumar R. (2023) noted that when planting on April 30, the yield of the lettuce variety 'Great Lakes' was significantly higher than with other dates.

The work of Saleh M.M.S. (2009) showed that sowing on August 15 formed a lower leaf mass compared to sowings on June 15 and July 15, while the winter variety 'Wild Romaine', sown on August 15, had higher leaf mass values than with other dates. At any sowing date, the summer romaine variety 'Nader' demonstrated a higher leaf mass to fresh weight ratio and leaf mass to stem mass ratio than the 'Wild Romaine' variety.

Research by Zhao F. (2000) and Cheng Y.F. (2005) proved the influence of varietal characteristics and different autumn sowing dates on the emergence rate, development, and yield of lettuce varieties. Results by Sarkar P.H.A. et al. (2025) showed that plant surface area (697.42 cm²), leaf length (21.75 cm), leaf width (20.75 cm), yield per plant (371 g), and total yield (14,271.30 kg/ha) were maximum when transplanting seedlings in the 3rd week of October.

The highest leaf lettuce yield (272.60 g/plant and 27.33 t/ha) was obtained from direct sowing in the field on November 1 (Shahinul M., 2019). With winter sowing of lettuce varieties in the field on November 30 with soil mulching, seeds begin to germinate in late January – early February, and the harvest matures in mid to late April (Bustanov Z.T., 2018).

Based on research by Kaleri A.H. et al. (2016), it was concluded that sowing on November 15 and December 1 provided the best results for plant height, number and mass of leaves, as well as high yield. Ahmad S. (2024) established that maximum chlorophyll content, number of leaves per plant, rosette height and diameter, fresh and dry mass, and leaf area were noted in plants planted on December 24.

Romaine lettuce planted in October, November, February, and March required an average of 64, 66, 75, and 67 days, respectively, to reach marketable maturity, but in the coldest months, the maturation period increased: up to 90 days in December and up to 98 days in January (Dufault R., 2006). When planted from October to March, the romaine variety 'Paris Island' formed plants with greater mass than when planted from October to February (Alas T. et al., 2018).

Research by Kussainova G. (2008) showed that in a greenhouse, lettuce is advisable to grow from the first decade of January to the second decade of February by sowing seeds. To obtain an early lettuce harvest in open ground, seedlings should be planted from the first decade of April to the second decade of May.

Given the variability of the chemical composition of lettuce depending on various factors, it is necessary to consider not only the nutritional value of varieties, but also its relationship with productivity and other economically valuable traits.

The aim of this research was to determine the optimal sowing dates for romaine lettuce varieties Quintus and Korolevskiy pir to obtain maximum yield in the spring period. The research was conducted in 2024–2025 at the Scientific Research Institute of Vegetable, Melon Crops and Potato (Uzbekistan).

Materials and Methods

Since there are no zoned varieties of the non-traditional crop – romaine lettuce (*Lactuca sativa* var. *longifolia*) in Uzbekistan, two promising romaine varieties, Quintus and Korolevskiy pir, were preliminarily selected from the collection and were included in the research. The zoned leaf lettuce variety Kok shokh (*Lactuca sativa* L.), widely distributed in the region, was used as a control for comparative evaluation.

Climatic conditions during the research years differed somewhat, but overall, the vegetation period was characterized by an increase in average air temperature from +15°C in April to +31°C in June, insignificant precipitation, and low air humidity. The soil of the experimental plot is typical long-irrigated sierozem. Irrigation was carried out via furrows.

Five sowing dates with a 10-day interval were studied: 1) February 20, 2) March 1 (control), 3) March 10, 4) March 20, 5) March 30. Seeds were sown in trays filled with a standard soil mixture for seedling cultivation in greenhouse conditions.

The research was conducted in accordance with generally accepted methodological recommendations (Azimov et al., 2002; Nizomov et al., 2023; Dospekhov, 1985).

Results and Discussion

Vegetation period. Differences in the passage of phenological development phases were noted between the studied lettuce varieties.

After sowing on different dates, the beginning of emergence (10%) was observed on days 4–6, and mass emergence on days 7–9 for all varieties. With sowings on February 20 and March 1, emergence occurred 2–3 days later compared to sowings on March 20 and 30, which is associated with lower soil and air temperatures in the early spring period.

The appearance of the first true leaf in seedlings depended on the sowing dates and was noted on days 14–17 after mass emergence. With the first and second sowing dates, this process was delayed by 4–6 days relative to later sowings. Planting of 30-day-old seedlings in open ground was carried out at the corresponding calendar times.

In field conditions, the beginning (10%) and mass (75%) technical ripeness of romaine and leaf lettuce plants differed depending on varietal affiliation and sowing dates.

Seedlings from the first sowing date were planted in the field at an air temperature of +17.7...+18.7°C, which caused slower growth rates compared to plants from subsequent planting dates when in April the temperature gradually increased to +20.8...+22.4°C, and in June – to +29.2...+30.0°C. The corresponding increase in soil temperature in these months favorably influenced growth processes.

For leaf lettuce Kok shokh sown on February 20, the phase of 10% technical ripeness occurred on day 45, and 75% on day 60 after mass emergence. In the control (March 1), these indicators were 43 and 56 days, respectively. When sown on March 10, the duration of the period to the beginning and mass technical ripeness was 43 and 52 days. With sowings on March 20 and 30, the beginning of technical ripeness was noted on days 37–40, and mass ripeness on days 45–48 after mass emergence.

For the romaine variety Quintus, emergence across all sowing dates was delayed by 2–3 days compared to the Kok shokh variety. When sown on February 20, the beginning of technical ripeness was recorded on day 59, 75% ripeness on day 76 after mass emergence; when sown on March 1, on day 58 and 73, respectively. When sown on March 10, the onset of technical ripeness accelerated by 3 days. Sowing on March 20 provided the beginning of

ripeness on day 53 and mass ripeness on day 65. The earliest dates for the onset of technical ripeness (day 49) and mass ripeness (day 59) were noted when sown on March 30.

The romaine variety Korolevskiy pir was characterized by indicators close to the Quintus variety in terms of the dynamics of emergence and first true leaf appearance. When sown on February 20, the beginning of technical ripeness was registered on day 58, and mass on day 73. When sown on March 1, these indicators were 53 and 69 days, respectively. Sowing on March 10 ensured the onset of 10% ripeness on day 51, and 75% on day 65. When sown on March 20, these values were 50 and 61 days, respectively. The shortest vegetation period from mass emergence to technical ripeness (48 and 57 days) was recorded when sown on March 30.

The conducted research revealed that the differences between the leaf lettuce variety Kok shokh and romaine varieties in terms of emergence and first true leaf appearance are insignificant (2–3 days). Subsequently, the differences intensify. A clear dependence of the onset of phenological phases on sowing dates was established. With the earliest sowing (February 20), the beginning of technical ripeness and mass technical ripeness occurred later for all varieties than with subsequent dates. This is explained by planting seedlings in the field during a period with lower air and soil temperatures, which slowed down plant development. As sowing dates shifted to later ones and correspondingly temperature conditions improved, plant development accelerated. In all variants with the control sowing date (March 1), the onset of 75% technical ripeness occurred 4–5 days earlier than with sowing on February 20. With sowing on March 10, the difference was 6–8 days; with sowing on March 20 – 11–12 days relative to sowing on February 20. All varieties were distinguished by the earliest onset of mass technical ripeness when sown on March 30, advancing by 15–16 days compared to sowing on February 20. The obtained data indicate that when grown in the spring period, the onset of technical ripeness in lettuce plants is directly dependent on sowing dates and accelerates when shifting from early to later dates.

Morphological traits. The research showed the presence of differences in plant growth parameters depending on the sowing date.

For the leaf lettuce variety Kok shokh with early sowing on February 20, the average height and diameter of the leaf rosette were 18.2 and 15.1 cm, respectively. With subsequent sowing dates (March 1 and 10), the rosette height increased from 21.4 to 22.8 cm, and the diameter from 19.3 to 25.9 cm. This was facilitated by the growth of the leaf apparatus: leaf length increased from 19.2 to 21.8 cm, and width from 18.5 to 20.1 cm. With sowings on March 20 and 30, all these parameters significantly decreased.

A similar dynamic was observed for romaine varieties. The Quintus variety, when sown on February 20, formed plants 20.0 cm high and 23.5 cm in diameter. When sown on March 1, the rosette height increased to 23.3 cm, and when sown on March 10 to 26.3 cm. Accordingly, the average rosette diameter, leaf length and width increased. With late sowings (March 20 and 30), growth processes were suppressed, and plants did not reach average varietal indicators.

The romaine variety Korolevskiy pir, when sown on February 20, also formed a small leaf rosette. When sown on March 1, the average rosette height was 21.3 cm, diameter – 23.4

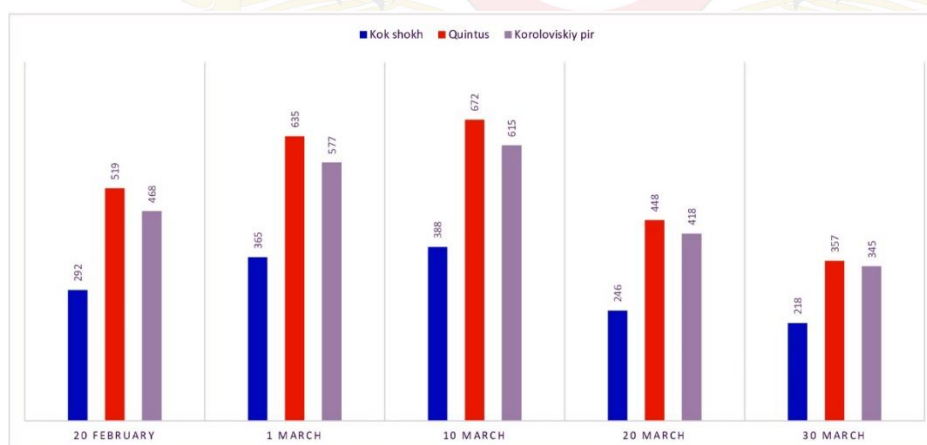
cm, leaf length – 22.1 cm, width – 11.4 cm. When sown on March 10, all rosette parameters increased. Sowings on March 20 and 30 led to a decrease in most of the studied indicators.

The variability of leaf rosette traits in all studied varieties demonstrates a clear dependence of plant growth on sowing dates and environmental conditions. With early sowing (February 20) and planting seedlings in open ground in early April, the air temperature averaged +15°C with minimums down to +12°C, which restrained growth processes and biomass accumulation. With sowings on March 1 and 10 and planting seedlings in the second–third decades of April, when the average temperature increased to +22°C, and the maximum reached +27°C, intensive plant growth was observed. Sowing at late dates (March 20 and 30) and planting seedlings under conditions of the onset of a hot period (average temperature about +29°C, maximum +32°C) negatively affected plant development, significantly slowing it down.

Average plant mass. Sowing dates had a significant influence on plant formation and their mass accumulation by the time of technical ripeness. It was established that at optimal planting density, the average plant mass of all varieties varied depending on the sowing date (Fig. 1).

For the leaf lettuce variety Kok shokh, the average plant mass when sown on February 20 was 292 g. When sown on March 1 (control), this indicator increased to 365 g and reached a maximum (388 g) when sown on March 10. Sowings on March 20 and 30 led to a decrease in average plant mass to 246 g and 218 g, respectively.

The romaine variety Quintus when sown on February 20, formed plants with a mass of 519 g. The highest values were noted when sown on March 1 (635 g) and March 10 (672 g). Subsequent sowing dates caused a significant reduction in mass: to 448 g (March 20) and 357 g (March 30).



Pic.1. Plant weight of lettuce varieties depending on sowing time.

The romaine variety Korolevskiy pir showed a similar dynamic of change in plant mass depending on the sowing date. When sown on February 20, the average mass was 468 g; when sown on March 1, it increased to 577 g, and when sown on March 10, it reached a maximum – 615 g. When sown on March 20 and 30, the plant mass decreased to 418 g and 345 g, respectively.

It should be noted that late sowing dates (March 20 and 30) negatively affected the qualitative characteristics of the leaves. Under conditions of high temperatures, not only was growth suppressed, but also an increase in bitterness in the leaves was noted, reducing their marketable suitability.

Yield. Since not only early maturity and plant mass are important for evaluating lettuce variety productivity, but also overall yield, an analysis of the influence of sowing dates on this indicator was conducted. The results indicate the presence of varietal differences in yield (Table 1).

Table 1. Influence of sowing dates on the yield of lettuce varieties.

Sowing time	Yield, kg/m ²		
	<i>Lactuca sativa</i>	<i>Lactuca sativa</i> var. <i>longifolia</i>	
	Kok shokh	Quintus	Korolevskiy pir
February 20	1,37	2,43	2,19
March 1 (control)	1,71	2,98	2,71
March 10	1,82	3,15	2,89
March 20	1,15	2,10	1,96
March 30	1,02	1,67	1,62
<i>LSD₀₅</i>	0,05	0,09	0,11
<i>Sx%</i>	3,4	3,5	4,7

The leaf lettuce variety Kok shokh when sown on February 20, formed a yield of 1.37 kg/m². When sown on March 1 (control), the yield increased to 1.71 kg/m², and the maximum value (1.82 kg/m²) was recorded when sown on March 10. Sowing on March 20 led to a yield reduction to 1.15 kg/m², and sowing on March 30 – to 1.02 kg/m².

For the romaine variety Quintus, the yield when sown on February 20 was higher than that of leaf lettuce and amounted to 2.43 kg/m². Within this variety, an increase in yield was observed when sown on March 1 (2.98 kg/m²) and a maximum value (3.15 kg/m²) when sown on March 10. Subsequent sowing dates (March 20 and 30) caused a decrease in yield to 2.10 and 1.67 kg/m², respectively.

The romaine variety Korolevskiy pir demonstrated a similar pattern of yield accumulation. When sown on February 20, the yield was 2.19 kg/m²; when sown on March 1, it increased to 2.71 kg/m², and when sown on March 10, it reached a maximum (2.89 kg/m²). Sowings on March 20 and 30 led to a decrease in yield to 1.96 and 1.62 kg/m², respectively.

Analysis of the data revealed a clear dependence of yield on sowing dates. As air and soil temperatures increased from early March to mid-March, the yield of both leaf lettuce and romaine gradually increased. However, with a further temperature increase above the optimal level, plant suppression was noted, causing a yield decrease with sowings on March

20 and 30. Compared to the early sowing on February 20, with sowing on March 20, the yield of all varieties decreased by an average of 16%, and with sowing on March 30, by 30–35%.

The obtained data for the mid-season romaine varieties Quintus and Korolevskiy pir indicate that when sown during the period from March 1 to 10, their plants develop under conditions of gradually improving illumination and increasing temperature, which promotes active growth and more intensive biomass accumulation compared to the earlier period (February 20 – March 1).

Conclusions.

1. The conducted research established that the indicators of technical ripeness onset, morphological parameters, plant mass, and yield of leaf lettuce and romaine varieties depend on their genetic characteristics, maturity group, as well as on agroclimatic conditions determined by sowing and harvesting dates.

2. To obtain the earliest (bunched) produce under the conditions of Uzbekistan, sowing on February 20 is advisable, providing a yield of leaf lettuce variety Kok shokh at the level of 1.37 kg/m² and romaine varieties – 2.19–2.43 kg/m².

3. Maximum yield was recorded for sowing on March 10. With this date, the yield of leaf lettuce Kok shokh was 1.82 kg/m², which is 6.4% higher than the control (March 1). Romaine varieties Korolevskiy pir and Quintus when sown on March 10 formed yields of 2.89 and 3.15 kg/m², respectively, which is 6.6% and 5.7% higher than the indicators of the control variant.

4. Late sowing dates (March 20 and 30) lead to a significant reduction in the yield of all studied varieties by 16–35% relative to the early sowing (February 20) and a deterioration in product quality (appearance of bitterness in leaves), making them agronomically impractical for spring cultivation.

5. Thus, to obtain a high yield of romaine lettuce under the conditions of Uzbekistan in the spring period, the optimal period for seedling sowing is from late February to mid-March, with a recommended priority for the date of March 10.

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