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CHANGES IN CLIMATIC CONDITIONS DURING THE CULTIVATION PERIOD OF EARLY CARROTS

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Abstract

This article presents information on the influence of active temperatures (above 5°C) occurring during different sowing periods of early carrots on the growth and development stages of the crop. The highest sums of active temperatures during the period from seed germination to technical maturity of root crops were recorded in the sowing periods of April 20 and May 1, amounting to 2720–2816°C. The lowest sum of active temperatures was observed in the first sowing period (April 1), reaching 1970°C.

Keywords: Temperature, sowing dates, growth and development stages, soil temperature, number of leaves.

Introduction

Carrot seeds begin to germinate at temperatures of -3 to -4°C; however, the optimum temperature for germination is considered to be 18–20°C. Six days after emergence, the first true leaf appears, while after thirty days the fifth true leaf is formed. Forty days after germination, when 7–8 true leaves are developed, root formation begins. The carrot root system, during its intensive growth period, penetrates to a depth of 2–2.5 m and spreads 1–1.5 m in width. For proper root crop formation, crops should be irrigated six times with a total water requirement of approximately 3–4.5 thousand m³ per hectare. To prevent root cracking, plants

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should be supplied with uniform moisture throughout the growing season. Climatic conditions play an important role in obtaining high yields of early carrots [1; 2; 3; 4; 5]. Therefore, it was decided to study climatic conditions under different sowing dates for early carrot cultivation.

Materials and Methods

Field experiments were conducted during 2023–2025 at the educational experimental fields of the Karakalpakstan Institute of Agriculture and Agrotechnologies. The experiments were arranged in four replications, with furrow lengths of 5 m. The early-maturing carrot variety **Mshak-195** was used. Phenological observations, biometric measurements, and climatic observations were carried out during the experiments. The methodology described by B.J. Azimov and B.B. Azimov in *Methods of Conducting Experiments in Vegetable, Melon, and Potato Production* was followed.

Results and Discussion

The field experiments evaluated four sowing dates: **April 1 (control), April 10, April 20, and May 1**.

According to meteorological station data, during the first ten days of April, the average air temperature was 16.6°C and soil temperature was 18.5°C. Under these conditions, 12 days were required from sowing until complete seedling emergence. In the second sowing period (April 10), despite higher air and soil temperatures of 20.4°C and 18.7°C, respectively, complete emergence also required 12 days (Table 1).

In the later sowing periods (April 20 and May 1), air temperatures during germination reached 21.4–23.2°C, while soil temperatures ranged from 21.9–24.4°C. Under these favorable conditions, seed germination occurred four days earlier than in the first two sowing periods, with full emergence observed after only 8 days.

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Field germination rates were 44–51% in the first two sowing periods, while they increased to 56% for the April 20 sowing and 53% for the May 1 sowing.

Phenological observations were conducted simultaneously with the determination of active temperature accumulation during the various growth and development stages. The highest accumulation of active temperatures during the period from germination to root formation was recorded for the April 20 and May 1 sowing dates.

Table 1 Effect of Sowing Dates on Carrot Seedling Emergence (2023–2025y)

Sowing Date	Daily temperature during seed germination, °C		Days from Sowing to Full Emergence	Field Germination %
	Air	Soil		
1- April	16,6	18,5	12	44
10- April (Control)	20,4	18,7	12	51
20- April	21,4	21,9	8	56
1- May	23,2	24,4	8	53

For the stage from germination to root formation, the accumulated active temperature in the first sowing period amounted to 330°C.

The stage from root formation to bunching maturity required 26 days in the control treatment, whereas it took only 23–24 days in the April 20 sowing period. Similar trends were observed in subsequent phenological stages. Delayed sowing dates resulted in higher active temperature accumulation and consequently accelerated crop development (Table 2).

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Table 2 Accumulation of Active Temperatures (>5°C) During Early Carrot Cultivation (2023–2025y)

Sowing dates			1- April (Control)	10- April	20- April	1- May
Stages of plant growth and development	**Seed emergence – root crop formation**	°C	330	356	405	448
		days	31	30	27	28
	Root crop formation – bunching maturity	°C	520	525	577,3	616,8
		days	26	25	23	24
	Bunching maturity – technical maturity	°C	985	1512	1566	1584
		days	60	58	57	57
	From seed emergence to technical maturity	°C	1970	2435	2720	2816
		days	116	114	110	111

Overall, the highest accumulation of active temperatures above 5°C during the period from germination to technical maturity was recorded for the April 20 sowing date (2720°C), while the lowest value (1970°C) was observed in the control treatment. Higher active temperatures accelerated the growing season, and technical maturity of root crops was reached within 110–111 days in the April 20 and May 1 sowing periods.

Conclusion

As sowing dates of early carrots are delayed from the earliest planting period, both daily air temperature and soil temperature at a depth of 5 cm increase. The rise in air and soil temperatures accelerates seed germination. Among the tested sowing dates, the highest accumulation of active temperatures (above 5°C) was observed for the April 20 sowing date, while the lowest accumulation occurred in the earliest sowing period on April 1.

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