

Technology of Growing Carrot Root for Storage and Processing

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Abstract: *the article provides information on the technology of growing carrot roots intended for storage and processing.*

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Carrot is a plant belonging to the celery family. Like many other root vegetables, carrots occupy an important place among human food products due to their richness in vitamins and minerals, good storage and ease of transportation.

About 22 varieties of it are regionalized in the republic. Among them, Baraka, Nurli 70, Mshak 195, Sariq Mirzoyi, Kyzil Mirzoyi 226 and others are the most common. Kyzil Mirzoyi is distinguished by the abundance of carotene in its composition.

Many regions of the republic are very favorable for growing root crops, including carrots.

Carrot belongs to the group of cold-resistant plants. It can withstand frosts of $-3-5^{\circ}\text{C}$. The most favorable temperature for the formation of roots is 20°C . At high temperatures, the development of carrot roots stops and they are deformed (bent).

The carrot plant develops very slowly, its 2-3 leaves are formed only 1-1.5 months after the appearance of grass, but at this time its root system develops rapidly, and even before the seed coat comes out on the soil, its root reaches a length of up to 10 cm, and at the same time it also forms side roots thickly covered with hairs. In a mature plant, the main part of the root system is located in a layer of soil up to 60 cm, some of it can penetrate up to 2 m. In the second half of its vegetation, when the plant has formed strong roots, carrots are not demanding on soil moisture.

Carrot seeds are more heat-demanding compared to their previous year's life. During the period of planting and establishment, the temperature suitable for them is $8-12^{\circ}\text{C}$, and for the formation of stems, it is $15-22^{\circ}\text{C}$. During this period, plants are very demanding on soil moisture. The best conditions for the filling and ripening of seeds occur in low relative humidity of the soil and air. Seeds harvested unripe or in wet weather are less viable.

Carrot is a pollinated plant. All cultivars interbreed easily with wild forms. Flowers are pollinated by insects that carry pollen up to 2 km. Therefore, it is necessary to mow wild carrots on roadsides, hedgerows and meadows within a radius of 2 km around the seed fields before they bloom.

Flowering of carrots begins 40-50 days after transplanting the mother rhizomes into the soil. The seeds bloom for about 25-30 days, the inflorescence is a complex umbel. It takes 60–65 days from germination to maturity of seeds on all plants.

In the conditions of the Khorezm region, 20-35 inflorescences are formed in each seed, in the southern regions, its number can even reach 50. Flowering of individual umbels lasts 4–5 days, and the entire inflorescence lasts 10–12 days. Carrot flowers have five stamens, the color is white in European varieties, and anthocyanin spots in Asian varieties, five stamens, seed pods are double-columned, and the bottom is two-celled.



Carrot blooms starting from the central flower. In the ball-complex umbel, the outer simple umbels first bloom, and in them, the outer flowers bloom first. It is done 12-24 hours before sowing seeds. Thus, the male zone of flowering gradually alternates with the female one.

When free-flowering, one umbel produces 1,000 to 2,000 seeds. From 2.5 to 15 g of seeds can be collected from one seed. 6–8 first umbels are left on the seedbed for better ripening of the seeds, and the rest are chipped if the seeding field is small.

Seeds in umbrellas of different orders do not ripen at the same time: in umbrellas of the first order - 40-45 days after flowering, in the second order - 50-55 days, in the third order - 60-65 days. The quality of the seeds collected from different types of branches is also different. The higher the order of the canopy from which the seed was collected, the lower its quality: the weight of 1000 seeds is small, germination power, germination and yield are low. This is due to the fact that the germination period of the seeds in the canopy of the second order is longer than that of the first order. The reason for this is that the seeds are placed at different levels and the length of the stalk is different, as well as the size of the seeds (larger seeds germinate faster than smaller seeds).

A characteristic feature of carrot varieties intended for local storage and processing is their tendency to shoot out bulbs in the first year. This is especially strongly observed in spring planting. During the cool and prolonged spring, the plants that produce gulpoya can reach 10-12% of the total crop. Early varieties are more prone to culling. The rhizomes of plants that have sprouted are thin, coarse, and bright orange, just like the wild forms. Gulpoya discharge is less observed in poor land than in fertile land. In carrots, the effect of low positive temperature should be from 10 to 20 weeks, depending on the variety.

For carrot varieties intended for local storage and processing, autumn crops like other root crops, buckwheat, corn for silage, cucumbers, onions, tomato-related vegetables, and potato are the best predecessors. It is known that carrots cannot be planted after sunflowers, dill, parsley, turnips, carrots and other celeriacs. Carrots can be replanted in the previously planted field after 3-4 years. In order to prevent the spread of diseases, it is recommended to place the crops of the first year at a distance of at least 500 m from those of the second year (seed).

The small size and shallow planting of carrot seeds requires careful pre-sowing soil treatment.

In the districts of Khorezm region, planting for storage and processing and seed purposes is carried out 5-10 days later than the period recommended in the literature for late and mid-season varieties, and 10-15 days for early varieties.

The rate of seeding for seed production is 5-6 kg/ha, the planting pattern is one row, the row spacing is 45 cm. Seeds are sown 2-3 cm deep. The thickness of plants should not be less than 600-800 thousand/ha.

When the seeds are sown thickly, when 2-3 leaves appear on the plants, and the diameter of the rhizome reaches 2-3 mm, it is fertilized by cross-fertilization.

In fertile soils, the least death of plants and a high level of tolerance to diseases are observed when phosphorus-potassium fertilization is carried out in the spring. Nitrogen fertilizers slightly reduce the resistance of carrots to sclerotiniosis, phomosis and other diseases. In this case, the natural reduction of roots during storage increases by 2-2.5 times. Good preservation of roots is achieved with nitrogen-phosphorus ($N_{90}P_{90}$) or complete mineral fertilization ($N_{90}P_{90}K_{120}$). It was found that storage capacity decreases not only when the amount of nitrogen is increased, but also when nitrogen, phosphorus or potash fertilizers are applied unilaterally. The shelf life of carrots also decreases when organic fertilizers are given.

The yield of mother rhizomes increases when there is a good supply of moisture. Watering is



carried out without lowering the soil moisture from 80%. Irrigation rate – 300–400 m³/ha.

In addition to its moderate demand for moisture, carrots require even moisture (especially during the period when the roots are forming). Carrots often get sick when they are watered on hot days. When the soil is overmoistened, in the first days of planting, the roots of about half of the plants become discolored, about 43% of them have branched roots, and in conditions of four days of excess moisture, this process is observed in almost all plants, that is, a non-standard product is obtained.

In the process of growing carrot roots intended for storage and processing, it is necessary to carefully monitor their growth and development. Roots do not keep well if they rot, and many die when transplanted. The weight of marketable root fruits grown under favorable conditions ranges from 100 to 300 g, depending on the variety.

In the first year, by the time of harvest, 500-700 thousand pieces of marketable roots are produced per hectare. 200,000-300,000 of them are selected for seed purposes. It is necessary to store 65-70 thousand roots for planting per hectare.

It was found that roots harvested late in fall and planted early in spring set faster, but stemming and flowering are observed in roots harvested early.

In Khorezm region, it is recommended to start the collection of mother plants no later than September 15-20, because it is necessary to have time to place them in storage before the onset of frost. When there is a threat of frost, they are made to cover in order to protect their growing point. In root crops, the leaf band is left 0.5-1 cm long.

According to the rule, approval is carried out before harvesting the root crops. A thorough knowledge of approval marks is required to correctly identify mixtures. When cross-pollinated, F₁ offspring have intermediate color and shape. Conical shape and sharp triangulation are dominant, cylindricity and obtuse triangulation are recessive characters. Annual forms are dominant over biennials, woody rhizomes over deciduous, spreading foliage over erect plants, and strong foliage over small foliage.

For better storage of root fruits, it is advisable to spray plants with 0.5% potassium chloride solution one month before harvesting. It is recommended to cut off the leaves as soon as the rhizomes are extracted, because even short-term storage with the leaves can cause the development of phomosis, alternariosis and sclerotiniosis.

Selection of mothers is carried out both in autumn and in spring. For autumn selection, roots are obtained that are healthy for storage, have the shape and color typical for the variety, and weigh not less than 75-120 g in small-fruited varieties, and 120-175 g in large-fruited varieties. The surface of the rhizomes should be as smooth as possible, the leaf band should be of the recommended length, the head should be beautiful, and the tip should be sharply transitioning to the root system.

In regions with warm and long-lasting autumn, root crops can be stored traditionally in trenches 50 cm wide, 35 cm deep and 10 m long. Mothers are placed in layers with sand or light soil. In this case, up to 400 kg of mother is placed in 1 m³ volume. In the coldest season, where the average temperature is -6.5°C, layering carrots with soil gives a good result (the yield is 3-5%). The trench is closed in 2-3 layers, that is, the number of layers is increased as the temperature drops.

It is desirable to store root vegetables and high-value carrot varieties intended for export in polyethylene bags covered with sawdust in refrigerated warehouses at a temperature of 0-1°C. In our experiments, the natural reduction is 1.2-1.5%, while the loss in cells reaches 11-12%. It has been confirmed in our experiments that keeping roots in polythene bags in trenches also gives good results. In this case, the storage capacity increases by 25-30% compared to layering with soil.



Places with fertile, neutral or weakly alkaline (pH 5.5-6) soil, slightly hilly, south or southwest slope are chosen for planting mother root crops. Seed carrots can be replanted in the same place after 3-4 years. It is not recommended to grow first-year carrots near seeds, as this situation can lead to the spread of many diseases.

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