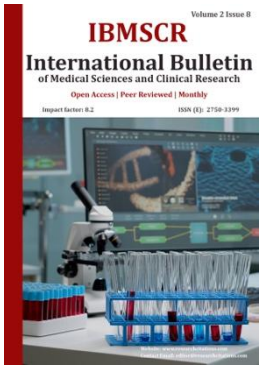


# THE KARMEN PEAR CULTIVAR (GRAFTED ONTO QUINCE A) — VALUABLE AGRONOMIC TRAITS OF A PROMISING VARIETY UNDER THE AGRO-CLIMATIC CONDITIONS OF UZBEKISTAN

**Pardabayev Sh.T.** [1]
**Yakhshibekov A.D.** [2]
[1] Deputy Director for Scientific Research and Innovation, Jizzakh Scientific-Experimental Station of the Horticulture, Viticulture and Winemaking Research Institute named after Academician M. Mirzaev.
[2] Director of the Jizzakh Scientific-Experimental Station of the Horticulture, Viticulture and Winemaking Research Institute named after Academician M. Mirzaev.
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**Annotation.** The article examines the growth, development, productivity, and valuable morphobiological and agronomic traits of the “Karmen” pear cultivar under the agro-climatic conditions of the Jizzakh region. The study was conducted during 2022–2025 in the Sharof Rashidov district territory of the Jizzakh Scientific-Experimental Station. The Karmen cultivar grafted onto Quince A rootstock demonstrated characteristics typical for this rootstock, including a dwarf growth habit, early fruiting, large fruit size, and strong market demand. These traits are widely reported for pear cultivars grafted on Quince A (Cydonia oblonga), which has shown high efficiency in intensive orchards in other studies as well [1].

Phenological observations, fruit quality parameters, disease resistance, and phytopathological diagnostics were analyzed. The average fruit weight was found to be 146.01 g, with a maximum of 190.67 g. The results indicate that the Karmen cultivar can be recommended as a promising variety for intensive horticulture in the Jizzakh region. This approach aligns with ongoing scientific efforts in Uzbekistan to introduce highly productive cultivars with strong market potential into modern orchard systems [2, 3].

**Introduction.** In the current period, the introduction of intensive cultivation technologies for fruit trees, as well as the selection of high-yielding, early-fruiting cultivars with strong market demand, is among the priority tasks in the horticultural sector of Uzbekistan. The pear (Pyrus communis L.) is one of the most widely cultivated fruit crops in the country and possesses significant export potential.

The “Karmen” cultivar, when grafted onto the Quince A (Cydonia oblonga) rootstock, is distinguished by its dwarf growth habit, early fruiting, large fruit size, and good transportability. However, its growth performance and economically valuable traits under the conditions of the Jizzakh region have not been sufficiently studied. Therefore, the present research is aimed at conducting an in-depth analysis of the agrobiological characteristics of the Karmen cultivar.

**Materials and Methods.** The research was conducted in 2025 in the experimental orchard of the Jizzakh Scientific-Experimental Station of the Horticulture, Viticulture, and Winemaking Research Institute named after Academician M. Mirzaev, located in the Sharof Rashidov district. The study utilized samples of the “Karmen” pear cultivar grafted onto the Quince A (Cydonia oblonga) rootstock. The experimental orchard was managed in accordance with standard agrotechnical requirements.

In this study, the "Karmen" pear cultivar grafted onto the Quince A (Cydonia oblonga) rootstock was examined. The Quince A rootstock belongs to the quince (Cydonia) genotype and is characterized by its ability to produce dwarf trees, induce early fruiting (in the 3rd–4th year), allow dense planting, and ensure high productivity. It is also relatively tolerant to soil calcareousness and salinity, making it suitable for intensive orchards. Although some regions report potential root system damage under severe winter conditions, no such cases were observed under the climatic conditions of Jizzakh.

The experimental orchard was established using a 4 × 2 m planting scheme, with trees irrigated through a drip irrigation system. Fertilization was carried out according to seasonal requirements based on standard NPK fertilization schemes. An integrated pest management (IPM) system—combining chemical, mechanical, and agrotechnical methods—was applied for controlling pests and diseases.

Phenological development stages were determined using the BBCH scale, and phenophases relevant to pear were recorded [4]. The beginning of flowering (BBCH 61–63), full bloom (BBCH 65), and fruit set (BBCH 71–73) stages were documented through regular observations of 10 trees. The onset date and transition to full phase for each stage were recorded in a daily observation log.

Pest and disease management measures were based on practical guidelines of the Republic of Uzbekistan for plant protection [6], as well as international FRAC recommendations. Phytopathological diagnostics were conducted following EPPO PM7-series standards [7], using visual assessment and symptom identification. Fungicides (Horus – 0.2 kg/ha, Skor – 0.3 L/ha) were applied before and after flowering, while an insecticide (Aktara – 0.15 kg/ha) was used at the bud stage. Damaged leaves were removed manually, and irrigation was regulated throughout the growing season as part of routine agrotechnical practices.

Fruit morphological indicators were evaluated based on the Pyrus spp. descriptors developed by IPGRI [5]. Fruit shape, color, average and maximum weight were assessed based on 30 fruit samples, with weight measured in grams using an electronic scale. Fruit shape was determined through visual assessment, and color was described using a standard color scale. The collected data were processed and summarized in tabular form.

All data obtained during the study were statistically analyzed using Excel 2021 and STATISTICA 10 software. Mean values, maximum parameters, and deviations were calculated.

**Research Results.** The results of phenological observations of the "Karmen" pear cultivar carried out in 2025 under the conditions of the Sharof Rashidov district are presented in Table 1. The initial phenophase—flowering onset—was recorded on April 18. At this stage, the first opened flowers were observed, marking the beginning of phenological activity in the orchard. Flowering continued to develop, and the full-bloom phase occurred on April 28. During this period, 80–100% of flowers were fully open, creating the most favorable conditions for pollination.

**Table 1.**
**Phenological development stages of the "Karmen" pear cultivar (2025, Sharof Rashidov district, Jizzakh Scientific-Experimental Station)**

| № | Phenological stage | Start date | Full phase date | Notes |
|---|---|---|---|---|
| **1** | Beginning of flowering | 18 April | — | First opened flowers |
| **2** | Full flowering | — | 28 April | 80–100% of flowers fully open |
| **3** | Fruit set | 5 May | — | Flowers wilted, initial fruitlets formed |

The next phase of phenological development—fruit set—was recorded on 5 May. At this stage, the flowers had completely wilted, and the formation of initial fruitlets was clearly observed. Strengthening of the fruit peduncle, the early stages of fruit growth, and the onset of initial elongation processes occurred actively during this period. This phenophase confirms the cultivar's early-fruiting characteristic and further demonstrates the suitability of the Karmen cultivar for intensive orchard systems.

The results of the phenological observations showed that the vegetative processes of the "Karmen" cultivar under the agro-climatic conditions of the Jizzakh region proceeded in a clear and stable manner, with spring temperatures favorably supporting the development of the cultivar. Moreover, the transition from flowering to fruit set occurred within a short period, which is one of the important advantages contributing to early ripening and the production of marketable fruit.

The Karmen pear cultivar is distinguished by its high fruit quality, early ripening, and vigorous growth traits. During the vegetation period, its tolerance to various agro-ecological factors was evaluated, with particular emphasis on its resistance to phytopathogens, fungal diseases, and pests (Figure 1).

**Figure 1. Damaged leaf and fruit.**

During the spring season of 2025, in the experimental plots at the Jizzakh Scientific-Experimental Station located in the Sharof Rashidov district, the “Karmen” pear cultivar (grafted onto Quince A) exhibited several pathological changes on the leaves. Numerous small red-brown spots were observed on the upper leaf surface, primarily along the marginal veins. In some leaves, these spots spread toward the central part, forming perforations, and in poorly developed leaf blades, small tears resembling mechanical damage were noted. On the lower leaf surface, whitish-green slimy traces occasionally appeared, indicating secondary symptoms associated with tissue damage.

Although the flowering process proceeded normally, a slowdown in leaf growth and slight retardation in the development of young leaves were observed, which are important indicators within this symptom complex. Such signs suggest the possible presence of diseases affecting the overall physiological activity of the plant during the vegetation period.

Analysis of the observed symptom complex indicated that the primary probable cause of leaf damage was Entomosporium leaf spot (causal agent: *Entomosporium maculatum*). This fungal disease is widespread in pear, quince, and some ornamental trees and is characterized by numerous small, dark-brown, circular spots on the leaves. Wet and rainy spring conditions favor active sporulation of the fungus and significantly increase the level of infection. Infected leaves exhibit reduced photosynthetic activity, which may negatively affect the overall growth vigor of the plant and its future productivity.

Thus, symptom analysis in the “Karmen” cultivar is crucial for early detection of the disease and timely implementation of phytosanitary measures.

**Preventive and control measures against Entomosporium in the Karmen pear cultivar.** To reduce the characteristic spotting and leaf damage caused by Entomosporium observed in Karmen pear, a comprehensive protection system was applied at the Jizzakh Scientific-Experimental Station. Due to the wet spring conditions and the sensitivity of the Quince A rootstock, an integrated approach combining chemical, agrotechnical, and sanitation measures was adopted.

Firstly, fungicide treatments were planned. The pre-flowering period corresponds to the peak sporulation of the pathogen; therefore, the fungicide **Horus** (cyprodinil) was applied at a dose of 0.2 kg/ha to limit the initial development of fungal spores. After flowering, during the stage when leaf surfaces were more susceptible to damage, **Skor** (difenoconazole) fungicide was applied at 0.3 L/ha to prevent further spread of leaf spotting.

Since some leaf damage was also caused by insects, the insecticide **Aktara** (0.15 kg/ha) was applied during the bud stage to reduce the plant's sensitivity to overall stress factors.

In addition to chemical treatments, agrotechnical measures were implemented. Severely infected leaves were regularly removed from the orchard to reduce sources of infection. The irrigation system was strictly monitored during the growing season to prevent excessive moisture, which promotes Entomosporium development. Irrigation was carried out according to the recommended schedule, avoiding overwatering (Table 2).

**Table 2.**

**Preventive and control measures against Entomosporium in the Karmen pear cultivar**

| Measure / Action | Product / Method | Application timing | Dosage / Rate |
|---|---|---|---|
| Fungicide | Skor (Difenoconazole) | Post-flowering | 0.3 L/ha |
| Fungicide | Horus (Cyprodinil) | Pre-flowering | 0.2 kg/ha |
| Insecticide | Aktara (Thiamethoxam) | Bud stage | 0.15 kg/ha |
| Agro-sanitation | Removal of damaged leaves | Continuous | Manually removed |
| Agrotechnical measure | Irrigation control | Throughout growing season | According to recommended schedule |

Overall, when chemical protection, sanitation measures, and proper agrotechnical practices were applied in combination, the spread of Entomosporium in Karmen pear trees was significantly reduced, allowing the plants to restore normal vegetative growth.

**Description of fruit morphological characteristics of the Karmen pear cultivar.** Analysis of the fruits of the Karmen pear cultivar studied at the Jizzakh Scientific-Experimental Station showed that the fruits are mainly elongated–pear-shaped, with notable variation in morphological traits. The fruit color ranged from reddish, reddish-green to light reddish-brown, demonstrating good color variability during the ripening process.

The average fruit weight was high, with some fruits exceeding 190 g. Among the analyzed samples, the largest fruit weighed 190.67 g (reddish-green), while the smallest average fruit weighed 93.65 g. These indicators confirm that the Karmen cultivar belongs to the group of large-fruited pears (Table 3).

**Table 3.**
**Description of fruit morphological characteristics of the Karmen pear cultivar**

| № | Fruit shape | Fruit color | Fruit weight (g) | Notes |
|---|---|---|---|---|
| 1 | Elongated–pear shape | Light reddish-brown | 174.12 | Very large fruit |
| 2 | Elongated–pear shape | Reddish | 93.65 | Medium-weight fruit |
| 3 | Elongated–pear shape | Reddish | 123.45 | Medium-weight fruit |
| 4 | Elongated–pear shape | Reddish-green | 190.67 | Largest fruit |
| 5 | Elongated–pear shape | Reddish-green | 173.0 | Large fruit |
| 6 | Elongated–pear shape | Reddish-green | 156.45 | Large fruit |

**Description of the economic and biological advantages of the Karmen pear cultivar.** Observations conducted under the semi-arid, continental climate conditions of the Jizzakh region showed that the Karmen pear cultivar adapts well to the region's warm, dry summers and cool winters. The trees demonstrate stable growth, branching, and fruiting throughout the vegetation period, confirming the cultivar's adaptability to the local agro-climatic conditions.

In terms of productivity, the cultivar exhibits high efficiency, with an average yield of 25–30 kg per tree during the experimental years. Under favorable agrotechnical conditions, including optimal fertilization and drip irrigation, yields exceeded 35 kg per tree. Early fruiting is associated with the Quince A rootstock, with the cultivar beginning to bear fruit in the 3rd–4th year, which is an additional advantage for intensive horticultural systems.

Regarding fruit quality, the cultivar meets consumer demands: fruits weigh 120–210 g, are large, ripen to a reddish hue, and have a sweet–sour taste with a distinctive pleasant aroma. The dwarf growth habit of the trees facilitates fruit harvesting, which can be carried out both manually and with mechanization.

The Karmen cultivar shows moderate transportability, with harvested fruits maintaining quality for 10–15 days, making them suitable for long-distance transportation. Its disease resistance is satisfactory, demonstrating medium-to-high tolerance to major diseases such as fire blight, leaf spot, and bacterial scorch.

The water requirement of the cultivar is moderate, and when drip irrigation is applied, improvements in fruit size, color, and flavor quality are observed. These characteristics make the Karmen cultivar a promising variety for intensive orchards under the agro-climatic conditions of the Jizzakh region.

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