# FOOD TECHNOLOGY AND FOOD INDUSTRY

*Статья поступила в редакцию: 14.08.2026*
*Статья принята к публикации: 19.08.2026*
*Статья опубликована: 28.08.2026*

***УДК 634.14***

## Influence of budding dates for quince cultivars on the survival of graft components

***Namozov Ikhtiyor Choriyevich***
*professor*
*Department of Fruit Growing and Viticulture, Tashkent State Agrarian University*
*Uzbekistan, Tashkent*
*ORCID: 0000-0002-7168-0141*
*E-mail: Ihtiyor_8226@mail.ru*

***Aynakulov Komiljon Bakhtiyor ugli***
*PhD student*
*Gulistan State University*
*Uzbekistan, Gulistan*

## Влияние сроков окулировки сортов айвы на приживаемость прививочных компонентов

***Намозов Ихтиёр Чориевич***
*проф.*
*кафедры плодоводства и виноградарства, Ташкентский государственный аграрный университет*
*Республика Узбекистан, г. Ташкент*

***Айнакулов Комилжон Бахтиёр угли***
*докторант*
*Гулистанский государственный университет*
*Республика Узбекистан, г. Гулистан*

### Abstract

This study descriptively evaluated the association between budding date and autumn graft survival in five quince cultivars-Samarkandskaya Krupnoplodnaya, Aromatnaya, Izobilnaya, Olmabehi and Otlichnitsa-on BA-29 clonal rootstock. Field observations were conducted in 2023–2025 across five budding windows from 20–30 July to 1–10 September. For each cultivar and date,

---

**Библиографическое описание:** Намозов И.Ч., Айнакулов К.Б.У. Влияние сроков окулировки сортов айвы на приживаемость прививочных компонентов // Universum: технические науки : электрон. научн. журн. 2026. 8(149). URL: https://7universum.com/ru/tech/archive/item/23324

**For citation:** Namozov I.C., Aynakulov K.B.U. Influence of budding dates for quince cultivars on the survival of graft components // Universum: Technical Sciences : electronic scientific journal. 2026. No. 8(149). Available at: https://7universum.com/ru/tech/archive/item/23324

failed buds were counted during summer and before the autumn inspection; total losses, established buds and autumn survival were calculated. The highest numerical values occurred on 11–20 August: 86.6 % in Samarkandskaya Krupnoplodnaya, 86.0 % in Aromatnaya, 83.8 % in Izobilnaya, and 84.2 % in both Olmabehi and Otlichnitsa. The lowest value (63.4 %) was recorded for Izobilnaya in early September. The available dataset contained treatment-level means but not year- or plot-level observations, so standard errors and ANOVA could not be reconstructed and differences are reported descriptively. Site-specific meteorological data, exact coordinates and soil characteristics were also unavailable, and assessment ended at the autumn inspection without spring budburst or winter-hardiness measurements. Within these limits, 11–20 August was the most favourable tested window for autumn graft establishment on BA-29. This timing should be verified using replicated experiments with environmental monitoring and post-winter assessment before a general nursery recommendation is made.

## Аннотация

В исследовании описательно оценена связь сроков окулировки с осенней приживаемостью прививочных компонентов пяти сортов айвы - Самаркандская крупноплодная, Ароматная, Изобильная, Олмабехи и Отличница - на клоновом подвое ВА-29. Полевые наблюдения проводили в 2023–2025 гг. в пять сроков: 20–30 июля, 1–10 августа, 11–20 августа, 21–30 августа и 1–10 сентября. Для каждого сорта и срока учитывали погибшие почки летом и перед осенней ревизией, суммарные потери, число прижившихся к осени почек и процент осенней приживаемости. Наибольшие числовые значения во всех сортах получены при окулировке 11–20 августа: 86,6 % у Самаркандской крупноплодной, 86,0 % у Ароматной, 83,8 % у Изобильной и 84,2 % у Олмабехи и Отличницы. Минимальное значение (63,4 %) отмечено у Изобильной в начале сентября. Доступные данные содержали средние по вариантам, но не исходные значения по годам и повторностям, поэтому стандартные ошибки и ANOVA восстановить было невозможно; различия представлены описательно. Точные координаты участка, почвенные и метеорологические показатели также отсутствовали, а наблюдения завершались осенней ревизией без оценки весеннего распускания почек и перезимовки. С учётом этих ограничений период 11–20 августа был наиболее благоприятным из испытанных для осенней приживаемости прививок; вывод требует подтверждения в статистически спланированных опытах с экологическим мониторингом и весенним учётом.

**Keywords:** quince, BA-29 rootstock, budding date, autumn graft survival, cultivar, nursery plant, vegetative propagation.

**Ключевые слова:** айва, подвой ВА-29, срок окулировки, осенняя приживаемость прививки, сорт, саженец, вегетативное размножение.

## Introduction

Expanding the assortment and quality of fruit planting material is a priority of Uzbekistan's Agricultural Development Strategy for 2020–2030 [1]. For quince nurseries, the choice of rootstock and budding date is important because graft union formation depends on the physiological condition of the graft partners and suitable seasonal conditions. BA-29 is a clonal quince rootstock used in pome-fruit production, and rootstock studies demonstrate effects on vegetative and generative traits, tree architecture, graft survival and orchard performance [2, 4–6, 9].

Propagation research demonstrates that quince genotypes differ substantially in rooting capacity and that substrate conditions may be more important than exogenous auxin for hardwood cuttings [3]. Where direct rooting is unreliable, grafting remains an important nursery strategy; successful union formation involves wound response, callus development and vascular reconnection [9–11]. Graft performance may therefore reflect both the cultivar–rootstock combination and the physiological state of the plant at budding. However, comparative field data on the timing of budding for locally important quince cultivars on BA-29 remain limited. The objective of this study was to compare autumn graft survival among five budding windows for five quince cultivars on BA-29 rootstock.

## Materials and methods

The field experiment was conducted during 2023–2025 with the quince cultivars Samarkandskaya Krupnoplodnaya, Aromatnaya, Izobilnaya, Olmabehi and Otlichnitsa budded onto BA-29 clonal rootstock. Five calendar windows were evaluated: 20–30 July; 1–10 August (control); 11–20 August; 21–30 August; and 1–10 September. Standard methods for phenological observations and assessment of fruit-crop nursery material were used [7, 8]. For each cultivar–date combination, 50 budded rootstocks were assessed in the reported design. Failed buds were counted during the summer inspection and again before the autumn inspection. Total mortality was calculated as the sum of both counts; the number established by autumn was calculated as 50 minus total mortality, and autumn survival was expressed as a percentage of the 50 budded plants. Throughout this article, survival refers specifically to establishment recorded at the autumn inspection.

## Statistical analysis

The available dataset contained treatment-level means only and did not retain year- or plot-level replicate observations. Accordingly, the results were summarized descriptively. Standard deviation, standard error, ANOVA, p values and least significant difference could not be reconstructed reliably and were not imputed. Numerical differences are therefore not presented as statistically significant.

## Site, environment and observation period

Exact trial-site coordinates, the soil profile, and temperature, relative humidity and precipitation records for the budding windows were not present in the available experimental records and were not included in the analysis. Spring budburst, overwinter survival and structural winter injury were also outside the observation period. These omissions limit causal interpretation and generalisation of the results.

## Results and discussion

Budding date showed a consistent numerical pattern across all five cultivars (Table 1). The highest observed autumn survival occurred on 11–20 August. Because inferential statistics could not be reconstructed, the following comparisons describe numerical differences only. The maximum value was 86.6 % for Samarkandskaya Krupnoplodnaya; Aromatnaya reached 86.0 %, Izobilnaya 83.8 %, and Olmabehi and Otlichnitsa 84.2 %. At the same date, total losses were 6.7–8.1 buds per 50 grafts. The pattern is broadly compatible with evidence that rootstock and cultivar combinations influence graft take, vegetative development and subsequent scion performance [2, 4–6, 9].

***Table 1.***

**Effect of budding date on autumn survival of quince graft components on BA-29 rootstock, 2023–2025**

| Budding date | Failed by summer inspection, no. | Additional failures before autumn inspection, no. | Total losses, no. | Live buds, no. | Graft take, % |
|---|---|---|---|---|---|
| ***Samarkandskaya Krupnoplodnaya*** | | | | | |
| 20–30 Jul | 7.5 | 8.3 | 15.8 | 34.2 | 68.4 |
| 1–10 Aug (control) | 5.3 | 6.8 | 12.1 | 37.9 | 75.8 |
| 11–20 Aug | 3.1 | 3.6 | 6.7 | 43.3 | 86.6 |
| 21–30 Aug | 5.2 | 6.3 | 11.5 | 38.5 | 77.0 |
| 1–10 Sep | 7.4 | 8.3 | 15.7 | 34.3 | 68.6 |
| ***Aromatnaya*** | | | | | |
| 20–30 Jul | 7.6 | 8.1 | 15.7 | 34.3 | 68.6 |
| 1–10 Aug (control) | 5.4 | 6.4 | 11.8 | 38.2 | 76.4 |
| 11–20 Aug | 3.2 | 3.8 | 7.0 | 43.0 | 86.0 |
| 21–30 Aug | 5.1 | 6.5 | 11.6 | 38.4 | 76.8 |
| 1–10 Sep | 7.5 | 8.9 | 16.4 | 33.6 | 67.2 |
| ***Izobilnaya*** | | | | | |
| 20–30 Jul | 7.5 | 8.8 | 16.3 | 33.7 | 67.4 |
| 1–10 Aug (control) | 6.4 | 7.5 | 13.9 | 36.1 | 72.2 |
| 11–20 Aug | 3.5 | 4.6 | 8.1 | 41.9 | 83.8 |
| 21–30 Aug | 6.2 | 7.4 | 13.6 | 36.4 | 72.8 |
| 1–10 Sep | 8.8 | 9.5 | 18.3 | 31.7 | 63.4 |
| ***Olmabehi*** | | | | | |
| 20–30 Jul | 7.4 | 8.3 | 15.7 | 34.3 | 68.6 |
| 1–10 Aug (control) | 6.3 | 7.2 | 13.5 | 36.5 | 73.0 |
| 11–20 Aug | 3.4 | 4.5 | 7.9 | 42.1 | 84.2 |
| 21–30 Aug | 6.1 | 7.5 | 13.6 | 36.4 | 72.8 |
| 1–10 Sep | 8.9 | 9.3 | 18.2 | 31.8 | 63.6 |
| ***Otlichnitsa*** | | | | | |
| 20–30 Jul | 6.9 | 7.8 | 14.7 | 35.3 | 70.6 |

| Budding date | Failed by summer inspection, no. | Additional failures before autumn inspection, no. | Total losses, no. | Live buds, no. | Graft take, % |
|---|---|---|---|---|---|
| 1–10 Aug (control) | 5.3 | 6.8 | 12.1 | 37.9 | 75.8 |
| 11–20 Aug | 3.8 | 4.1 | 7.9 | 42.1 | 84.2 |
| 21–30 Aug | 5.1 | 7.9 | 13.0 | 37.0 | 74.0 |
| 1–10 Sep | 7.8 | 8.2 | 16.0 | 34.0 | 68.0 |

*Note. Values are descriptive means for the 2023–2025 observation period; each cultivar–date combination was assessed on 50 budded rootstocks in the reported design. Year- and plot-level observations were unavailable, so uncertainty estimates and ANOVA could not be reconstructed.*

Compared numerically with the 1–10 August control, the 11–20 August window was higher by 10.8 percentage points in Samarkandskaya Krupnoplodnaya, 9.6 in Aromatnaya, 11.6 in Izobilnaya, 11.2 in Olmabehi and 8.4 in Otlichnitsa. At late July, autumn survival ranged from 67.4 % to 70.6 %; at early September it ranged from 63.4 % to 68.6 %. The largest late-season numerical reductions occurred in Izobilnaya and Olmabehi. Without replicated inferential analysis, these contrasts should not be interpreted as proof of treatment significance or cultivar-specific sensitivity.

Summer and autumn counts showed the fewest failed buds after budding on 11–20 August and more failures at earlier and later dates. Mechanistic studies link successful graft union formation with wound response, callus development and vascular reconnection [10, 11]. However, cambial activity and meteorological conditions were not measured in the present experiment, so they cannot be identified as causal explanations for the observed pattern. The descriptive results are consistent with the broader evidence that genotype and rootstock influence graft take and subsequent development [2, 9]. **Study limitations.** The absence of year- and plot-level observations prevents estimation of variability and statistical significance. Missing geographic coordinates, soil data and meteorological series restrict transfer of the findings to other nursery environments. In addition, same-season autumn inspection does not establish long-term graft success: spring budburst, winter injury and later structural integrity require separate assessment.

## Conclusion

Among the five tested dates, budding on 11–20 August was associated with the highest observed autumn survival in all five quince cultivars on BA-29: 83.8–86.6 %, with total losses of 6.7–8.1 buds per 50 grafts. Late-July and early-September dates had lower numerical establishment. These differences were not statistically verified because replicate-level data were unavailable. Therefore, 11–20 August should be regarded as a candidate favourable window within the observed dataset rather than a definitive general recommendation. Replicated trials should report exact location and soil characteristics, monitor weather during budding, retain year- and plot-level data for ANOVA and uncertainty estimates, and include post-winter budburst and graft-integrity assessments.

## References


1. Mirziyoyev Sh.M. On measures for the implementation in 2020 of the tasks defined in the Strategy for Agricultural Development of the Republic of Uzbekistan for 2020–2030: Resolution of the President of the Republic of Uzbekistan No. RP-4575 of 28 January // National Database of Legislation of the Republic of Uzbekistan. – 2020. – № 07.
2. Tatari M., Rezaei M., Ghasemi A. Quince rootstocks affect some vegetative and generative traits // International Journal of Fruit Science. – 2020. – T. 20. – DOI: 10.1080/15538362.2020.1764462.
3. Aziz R.R. Hama-Salih F.M., Noori I.M. Rooting of hardwood cuttings of quince (Cydonia oblonga L.) as influenced by IBA and rooting substrate // Kufa Journal for Agricultural Sciences. – 2024. – T. 16, № 3. – P. 24–40. – DOI: 10.36077/kjas/2024/v16i3.11298.
4. Friend A.P., Diack R.N. van Hooijdonk B.M., Knäbel M., Tustin D.S., Palmer J.W. Scion architecture on dwarfing candidate pear rootstocks // Acta Horticulturae. – 2020. – № 1281. – P. 153–162. – DOI: 10.17660/ActaHortic.2020.1281.22.
5. Kul Y.M. Öztürk A., Faizi Z.A. Evaluation of different rootstocks and cultivars on pruning weight in young pear trees // Black Sea Journal of Agriculture. – 2022. – T. 5, № 4. – P. 440–447. – DOI: 10.47115/bsagriculture.1167288.
6. Polat A.A. Performance of high-density loquat orchard with quince rootstocks: effects on yield, fruit quality and vegetative growth // Italus Hortus. – 2025. – T. 32, № 3. – P. 26–43. – DOI: 10.26353/j.itahort/2025.3.2643.
7. Buriyev Kh.Ch., Enileev N.Sh., Asatov Sh.I. et al. Methods of recording and phenological observations in experiments with fruit and berry plants. – Tashkent: Tashkent State Agrarian University, 2014. – In Uzbek. –. 2026. URL: UniLibrary (accessed 27.08.2026) (accessed 13 August) – 2026. – 64 c.
8. Moiseychenko V.F. Methods of recording and observations in experiments with fruit and berry crops: methodological recommendations. – Kyiv, 1987. – 68 P. – In Russian.
9. Öztürk A. The effects of different rootstocks on the graft success and stion development of some pear cultivars // International Journal of Fruit Science. – 2021. – T. 21, № 1. – P. 932–944. – DOI: 10.1080/15538362.2021.1948376.
10. Pina A., Errea P. A review of new advances in mechanism of graft compatibility–incompatibility // Scientia Horticulturae. – 2005. – T. 106, № 1. – P. 1–11. – DOI: 10.1016/j.scienta.2005.04.003.
11. Tzeela P., Yechezkel S., Serero O., Eliyahu A., Sherf S., Manni Y. et al. Comparing adventitious root-formation and graft-unification abilities in clones of Argania spinosa // Frontiers in Plant Science. – 2022. – T. 13. – DOI: 10.3389/fpls.2022.1002703.