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ORGANIC HAZELNUT PRODUCTION IN BULGARIA: POTENTIAL, CHALLENGES, AND DEVELOPMENT PROSPECTS

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Abstract

In the context of the growing demand for organic food and sustainable agro-ecological practices, hazelnut production in Bulgaria reveals significant potential for development within organic agriculture.

This article explores the potential, challenges, regulatory prerequisites and development perspectives of organic hazelnut production in Bulgaria. Hazelnuts represent a valuable crop for diversifying organic farming systems and promoting sustainable rural development. The paper analyzes ecological, agronomic, and socio-economic factors influencing the sector, highlighting the advantages of organic hazelnut cultivation in enhancing biodiversity and soil health. Major challenges include pest and disease management without synthetic inputs, limited technical knowledge and infrastructure, and institutional and market barriers. The article concludes with recommendations for policy support, research priorities, and practical measures to strengthen the sustainability and competitiveness of organic hazelnut production in Bulgaria.

The conclusions emphasize the need for an interdisciplinary approach and targeted investments to realize organic hazelnut production as a sustainable and competitive part of Bulgarian agriculture.

Keywords: Organic hazelnut production, Sustainable agriculture, Pest management, Biodiversity, Agroecology, Rural development

Introduction

The European hazelnut (*Corylus avellana* L.) is one of the most important species among the nut crops. Global production relies largely on selections from wild forms, with more than 400 varieties described, but fewer than 20 are suitable for commercial cultivation (Mehlenbacher, 1991).

Most of the harvest (90–95%) is intended for processing, with preference given to varieties with small, round, easy-to-blanch nuts of high quality, used in the production of confectionery and bakery products, dairy products, hazelnut butter, and cocoa-based chocolate products. Hazelnuts are also valued for their nutritional properties and potential applications in cosmetics and pharmaceuticals (Delgado et al., 2010). Rising global demand has driven expansion in traditional producing countries such as Türkiye, Italy, Spain, Georgia, and the USA, as well as emerging producers including Australia, South Africa, and Chile (Pacchiarelli et al., 2022).

The growing global demand for sustainably produced nuts, combined with the need for environmentally friendly farming systems, has positioned hazelnut as a promising crop for organic agriculture. It is adaptable to various agro-climatic zones, suitable for diversification of farming systems and beneficial for ecosystem services.

In Bulgaria, favorable climatic and soil conditions, along with increasing interest in organic farming, provide a solid foundation for developing this sector. Hazelnuts offer economic opportunities for farmers while contributing to agroecological resilience by supporting biodiversity and improving soil structure.

Despite this potential, organic hazelnut systems face challenges related to pest management, production technology, and market access. This makes the topic both timely and relevant for scientific analysis and strategic planning. Currently, there is a noticeable lack of comprehensive research on hazelnut production in Bulgaria. Existing studies focus primarily on conventional production technologies and a few agronomic aspects, leaving organic hazelnut cultivation unstudied. This gap highlights the urgent need for interdisciplinary studies to develop locally adapted technologies for organic systems, providing a foundation for practical applications, sustainable management, and policy development in the sector.

Global development and trends in hazelnut production

Global hazelnut production has steadily increased over recent decades, driven by increasing demand from the confectionery and health food industries, as well as the expansion of organic and sustainable food markets (Aydogan et al., 2018). The hazelnut production remains geographically concentrated, with Turkey, Italy, Azerbaijan, Georgia and United States accounting for over 90% of the world's total output (Coppola et al, 2022). Between 2013 and 2023, global hazelnut cultivation expanded to 1 078 192 ha, producing approximately 1 125 220 tons of in-shell nuts with average yields of 1 043 kg/ha (FAOSTAT, 2025). World leader in hazelnut production is Turkey (746 749 ha, 650 000 t), followed by Italy (87 500 ha, 102 740 t), and the USA (30 756 ha, 85 460 t). Emerging new significant producers are Chile, South Africa and Australia. In general, world production shows an increasing trend from the beginning of the last century, in response to the demand of the confectionery industry which processes about 90% of the harvested nuts, while the remaining 10% is sold as in-shell nuts (Cristofori et al, 2019).

The rapid growth of the organic segment is particularly relevant. Organic hazelnuts are increasingly demanded in premium food markets, where their added value is linked to environmental benefits, traceability, and compliance with strict production standards. This trend creates new opportunities for smaller countries with favorable agro-climatic conditions to target niche markets.

Organic hazelnut production in EU and Bulgaria

Organic farming provides an alternative approach to crop management, emphasizing environmentally friendly practices that preserve biodiversity and minimize the use of synthetic plant protection products. The European Union defines organic production as an overall system of farm management and food production that combines best environmental and climate practices, a high biodiversity, conservation of natural resources and high production standards (Karova, 2011; Mercati, 2016; Bartzas et al., 2017). The importance of organic farming is inderscored by the European Commission's Farm to Fork strategy (2020), which aims to expand organic farming areas across the EU, targeting at least 25 % of agricultural land under organic management by 2030 (EU Commission, 2020). A defining feature of organic farming is its adherence to strict regulations and standards (Karova & Dzhabarova, 2012). The main principles, certification requirements and rules regarding labelling and marketing of organic products are established by Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products, which applies to all operators involved in production, processing, and distribution of organic products, including those in conversion.

In recent years, the organic farming sector in the EU has expanded rapidly, in terms of land area, number of organic farms and total operators. By 2022, organic agricultural land reached 16.9 million hectares, representing 10.5% of total EU farmland (EU Commission, 2024). Between 2012 and 2022, the area under organic management increased by 7.4 million hectares, a 79% growth. France (2.9 million ha), Spain (2.7 million ha), Italy (2.3 million ha), and Germany (1.6 million ha) accounted for 56% of the EU's total organic area.

Nevertheless, organic farming is recognized as a priority sector for the country's agriculture and food production (Popov & Karova, 2015), and national support measures over the last decade have driven rapid growth (+182%) in organic areas between 2012 and 2022, currently it occupies less than 2% of agricultural land in Bulgaria (EU Commission, 2024). In the same time Bulgaria ranks among the countries with the lowest share of fully converted certified areas (55%), highlighting substantial potential for further development. The National Action Plan for the Development of Organic Production aims to increase the share of organic lands to 6.98% by 2027 (MAF, 2025). This plan reflects a consensus among stakeholders, including the Ministry of Agriculture and Food (MAF), organic producer associations, processors, traders, control authorities, consulting organizations, and NGOs, and provides a robust framework for promoting organic farming as a tool for sustainability and sector development. Its objectives include increasing certified organic areas, and expanding the number of organic operators, as well as enhancing consumer confidence in organic products, and developing national and international markets. The plan also supports the transition of conventional farms to organic production and strengthens the entire value chain through interventions and schemes outlined in the Strategic Plan for the Development of Agriculture and Rural Areas of the Republic of Bulgaria 2023–2027.

Current Development and Challenges of Organic Hazelnut Production in Bulgaria

Hazelnut cultivation in Bulgaria remains relatively limited compared to other nut crops, yet interest in this sector has steadily increased over the past decade. The country's temperate climate, suitable soils, and favorable agro-ecological conditions provide a strong foundation for expanding hazelnut orchards, particularly in regions with mild winters and well-drained soils. Traditionally, small orchards were integrated into diversified farming systems, but in recent years larger commercial plantations have also emerged. In Bulgaria, the first hazelnut plantations were established in the 1930s (Iliev & Zdravkov, 1962), and by 1980 hazelnut production area reached only 150 ha, mainly on low-yielding and sloping terrain (Nedev et al., 1976). Blagoeva (2020) notes that after 2010, the creation of new hazelnut orchards was stimulated by financial support under the Rural Development Program 2007-2013. By 2017, harvested orchards reached nearly 600 ha, and after 2013, approximately 2 000 ha of new hazelnut orchards were planted, which, if properly managed, could significantly increase production. According to FAOSTAT (2025) in 2023 the harvested area in Bulgaria reached 1 720 ha, producing 800 tons of in-shell nuts with an average yield of 465.1 kg/ha, reflecting slow but steady growth since 2013, when only 120 ha were harvested for a total 15 tons. However, the yield trend over a decade shows no increase, fluctiationg among 400 and 800 kg/ha, which might be an indication of lack of appropriate cultivation practices or cultivar set.

Official data on organic production in Bulgaria are collected by the MAF, and indicate a stable trend of increasing of both the number of farms and the areas under organic production. The latest data, retrieved from the published organic certificates of the producers indicate that by 2025, organic hazelnut plantations cover 1 614 ha, with projected production of 223 tons. There are 192 officially registered and certified producers accross almost all regions of the country (MFA, 2025). The largest areas of hazelnut plantations are located in the districts of Stara Zagora (367 ha), Ruse (272 ha), Veliko Tarnovo (150 ha), Montana (9132 ha) and Shumen (104 ha), while the highest number of farms is in the districts Ruse (24), Varna (19), Razgrad (15), Stara Zagora and Burgas (14). For comparison, even in Turkey, a global leader in hazelnut production, organic cultivation represents a relatively low share with 21 418 tons of organic hazelnuts harvested from 12 129 ha accross 18 provinces (Turan, 2023).

Although organic hazelnut production in Bulgaria currently represents only a small share of the national sector, it possesses potential for growth. Organic orchards offer multiple advantages, contributing not only to rural economic development but also to key ecosystem services such as soil stabilization, carbon sequestration, biodiversity conservation, and the maintenance of habitats for pollinators.

Nevertheless, scientific research on hazelnut production in Bulgaria remains limited, and studies specifically addressing organic management, pest and disease dynamics, and locally adapted integrated management strategies are absent. Further challenges include insufficient technical expertise, limited access to certified organic planting material, inadequate processing infrastructure and weak market integration. To unlock the opportunities associated with organic hazelnut production

and transform it into a viable and competitive sector, targeted research, innovation, and supportive policy measures are essential. Priorities should include the establishment of demonstration farms, the development of specific cultivation guidelines, and the promotion of producer cooperation to strengthen knowledge exchange and market access.

Ecological and agronomic perspectives

Hazelnut orchards provide unique opportunities to integrate ecological and agronomic objectives within sustainable and organic farming systems. In recent years, there has been a growing awareness of the importance of adopting a holistic approach to biodiversity, including agrobiodiversity, its conservation, sustainable use, and development. These principles are enshrined in the Convention on Biological Diversity, as well as in the European Strategy for Resource Efficiency to 2050 (Bacchetta et al., 2015). Coppola et al (2022) applied Life Cycle Assessment (LCA) approach to evaluate environmental impact of the conventional and organic hazelnut farming systems in Viterbo province in Italy, highlighting the potential of sustainable production systems.

From an ecological perspective, hazelnut plantations play an important role in enhancing agroecosystem diversity. They provide habitat for beneficial arthropods, pollinators, and soil organisms, while contributing to carbon sequestration and soil protection through permanent vegetation cover. Hazelnuts help prevent erosion, improve water retention via deep roots and canopy shading, and diversify the landscape to strenghten ecological connectivity and reduce pest pressure. Vlahova (2020) emphasizes that hazelnuts increase the ecological value of agricultural landscapes. These ecological benefits are consistent with organic farming and agroecology principles, where biodiversity functions as a natural mechanism for pest and disease regulation. Such outcomes can be further supported achieved through the use of flowering cover crops, hedgerows, and ecological corridors.

From an agronomic perspective, for successful hazelnut harvest, key factors include proper cultivar set choice, effective soil fertility practises, adequate water management and annual orchard management practices. Considering that agroclimatic conditions in Bulgaria are quite versatile, achieving the upper-mentioned factors while complying with organic farming regulations require well-structured and consecutuve approach. Up to date the existing studies on hazelnuts in Bulgaria focus on conventional cultivation, agronomic techniques or cultivar adaptation. The most common hazelnut cultivars grown in Bulgaria in last decades were introduces in past from Turkiye and belong to *Corylus avelana* L., *Corylus maxima* Mill. or their hybrids. Most of them are low-productive in our country because they are very susceptible to adverse climatic conditions - drought and high summer temperatures. In addition, most of them are unknown to processors and exporters, highlighting the need for varietal diversification aligned by market preferences. Since 2019, a new cultivar set was introduced for regional studies in Bulgaria, including most of European prime industry hazelnut cultivars, as well as some new promising American ones. Several plantations have already been established in different regions in Bulgaria aiming evaluation of cultivars's performance and level of adaptation (Blagoeva, personal communication).

Hazelnut training systems as bush or tree (single-stemmed or grafted) have been studied extensively (Nikolova, 2006, 2009). Each training choice has its advantages and problems, depending on farmer's cultivatoin method and orchard management. Nevertheless, many producers prefer single-stemmed hazelnuts due to easier soil management and harvesting. In addition, it allows plantation of denser garden with more plants per hectare. It turns out to be most preferable for organic cultivation of hazelnut, because allows mechanical maintenanace.

Building long-term natural soil fertility and nourishing plants primarily through the soil ecosystem is a main goal of farmers in organic production. This is achieved by implementing practices maintaining and increasing soil organic matter and biological activity, improving its resilience and biodiversity, and preventing soil compaction and erosion. In hazelnut orchards, such practices include sowing cover crops, green manure crops, and legumes in the interrows; and applying manure or composted organic matter, preferably from organic sources.

Plant nutrient requirements should be determined based on soil and leaf analyses, as well as overall plant condition (Senol, 2019). Turan (2023) recommends soil sampling in late July and 10-15 days before harvest. Islam et al (2019) and Ozkultlu (2020) suggest applying manure in 50-60 cm wide strips around bushes every 3-4 years in autumn or early spring and incorporating it into soil. According to Regulation (EU) 2018/848, manure can only be applied under specific conditions: it must come from local organic farms or extensively raised non-organic livestock.

Where suitable manure is unavailable, green manures such as vetch, wild peas, and oats can be applied for several consecutive years, sown in autumn and incorporated in spring before flowering (Turan, 2020). Hazelnut husk may also be composted and applied around the crown projection to a depth of 5-10 cm (Ozukultu, 2020), with organic origin required in organc systems. Since hazelnuts thrive at soil pH between 5-7, limimg may be applied if necessary.

Where these practices are unsufficient to meet nutritional needs, authorized organic fertilizers, soil conditioners and nutrients may be used in compliance to Annex II of Commission implementing Regulation (EU) 2021/1165 of 15 July 2021 which defines allowed substances and conditions. Total annual amount of nitrogen input from manure must not exceed 170 kg/ha, and mineral nitrogen fertilisers are prohibited. Microbial preparations may be used to improve the overall condition of the soil or availability of nutrients in the soil or in plants. Suitable preparations of plants and microorganisms may be used to activate compost, and biodynamic preparations are also permitted.

Pest and Disease Management in Organic Hazelnut Production

Insect and mite pests cause serious damage to the hazelnut crop worldwide. In Georgia, the ambrosia beetle (*Xyleborus dispar* Fabricius), bud mite (*Phytoptus avellanae* Nal.) and hazel long-horned beetle (*Oberea linearis* L.) are reported as the three main pests of hazelnut (Kereselidze et al, 2018). Roversi (2016) lists the major pests and diseases affecting hazelnuts in Italy, comparing organic and conventional cultivation trials from Italy and Turkey. The study emphasizes that effective organic hazelnut cultivation requires professional expertise equal to or exceeding that of conventional growers.

In Europe and Western Asia, the hazelnut weevil (*Curculio nucum* L.) is widespread, affecting both cultivated and wild hazelnuts (Kollár, 2007; Gültekin, 2020), in Poland it is considered a major pest (Gantner and Jaśkiewicz 2002). In southeastern Poland, Gantner (2001) reported on hazelnut aphids (*Myzocallis coryli* Goeze) and *Corylobium avellanae* Schrank, the plum scale (*Parthenolecanium corni* Bouche) and the bud mite (*Ph. avellanae*). In the Pacific Northwest of the USA *Cydia latiferreana* Wals. causes over 20% nut damage on unsprayed hazelnut trees, while other pests, filbert leafroller (*Archips rosanus* L.), and filbert aphid (*Myzocallis coryli* Goeze), were found in lower densities (AliNiazee, 1983). Other significant pests and pathogens in the USA include big bud mite (*Ph. avellanae*), eastern filbert blight (*Anisogramma anomala* Peck), bacterial blight (*Xanthomonas corylina* Dowson), (Gantner, 2005; Lagerstedt, 1980; Pinkerton et al., 1993). Invasive species, such as the brown marmorated stink bug (*Halyomorpha halys* Stal) cause damage throughout the growing season in Oregon (Hedstrom et al., 2014). It has been reported also in Turkey, where other economically important pests include *H. dispar*, *P. corni*, *O. linearis*, *Ph. avellanae*, *Melolontha melolontha* L., *Gypsonoma dealbana* Fr., *Palomena prasina* L., *Hyphantia cunea* Dr., while diseases include powdery mildew (*Phyllactinia guttata*, *Erysiphe corylacearum*), stool death (*Pseudomonas avellanae*), bacterial blight (*Xanthomonas arboricola*), and grey necrosis (*Fusarium* spp., *Alternaria* spp.) (Islam et al., 2018; Turan et al., 2009; Koloren, 2020). An invasive species for Europe is the Asian sawfly (*Anoplophora glabripennis* Mot), which originates from Asia (Japan, Vietnam, China, Malaysia, Korea), and in Europe has been reported in France (Corsica), Italy and Russia as a pest of the tree hazel C. colurna (EPPO, 2025).

Historically, economically important pests were reported in Bulgaria in the 1980s, but recent studies are scarce (Bobev, 2018). Ivanova (2018) lists hazelnut borer (*C. nucum* L.), long-horned borer (*O. linearis* L.), stinky wood borer (*Cossus cossus* L.), trunk beetle (*Attelabus nitens* Scop.) and the bud mite (*Ph. avellanae* Nal.) as relevant pests. While some pests and pathogens are not yet recorded in Bulgaria, climate change and increased trade raise the risk of their introduction.

Pest and disease management represents a critical challenge for organic hazelnut production. Reducing pesticide use and employing biological or agroecological methods are essential for environmental protection and biodiversity conservation (Karova & Ilieva-Pencheva, 2024). Organic systems prohibit synthetic pesticides, necessitating preventive and ecological measures integrated into IPM strategies. Effective management combines monitoring, promotion of beneficial organisms, habitat management, and biological control to maintain pests below economic thresholds while preserving ecosystem functions. Biological control utilizing predators, entomopathogenic fungi such as *Beauveria densa* Link against *C. nucum* larvae, and other natural enemies may be applied (Rusen et al, 2005). Mechanical methods such as collecting fallen nuts and cones, pruning diseased or interior branches, and maintaining proper bush structure for ventilation and sunlight are highly effective (Islam & Serdar, 2020; Turan, 2020). Inter-row cover crops can play a significant role by providing habitat for beneficial species (Minkova & Karova, 2024). When necessary, only products authorized under Regulation (EU) 2021/1165 may be used. Registered substances in Bulgaria include microbial agents (*Bacillus*

thuringiensis, *B. amyloliquefaciens*), low-risk actives (ferric phosphate), fatty acids, maltodextrin, paraffin oils, sulfur, Bordeaux mixture, copper hydroxide, copper oxychloride, and pheromones (BFSA, 2025). Copper use is limited to a maximum of 28 kg/ha over 7 years (EU Implementing Regulation 540/2011).

Weed management is achieved primarily through soil cultivation, as herbicides are prohibited.

Financial Incentives and Perspectives

The European Union supports organic farming as the organic food market contributes to food security and sustainability (Spiegel et al., 2022). Currently, organic farming in the EU is subsidised through annual per-hectare payments, based on commitments typically lasting at least five years. Policy support has been shown to promote the expansion of organic farming areas.

In Bulgaria, financial support is among the most important incentives for increasing organically managed land. It is implemented primarily under the *Organic Plant Production* intervention of the Strategic Plan for Agriculture and Rural Development 2023–2027, which provides EUR 735.56/ha for areas in conversion (declared before 01.01.2024) and EUR 595.34/ha for certified organic areas. Current rates have increased to EUR 787/ha and EUR 647/ha respectively. Additional funding is available under agroecology, climate, and biodiversity interventions.

These financial mechanisms, combined with growing market opportunities, are expected to stimulate further expansion of organic hazelnut production. However, this also underscores the need for enhanced scientific research to address practical challenges, maintain good phytosanitary and agronomic conditions, and ensure economic viability of organic hazelnut farms.

Conclusions

Organic farming is increasingly recognised as a cornerstone of the agroecological transition within the European Union and national agricultural policies. In this context, both ecological and agronomic perspectives highlight the multifunctional potential of hazelnut production systems. When effectively managed, these systems can combine economic viability with biodiversity conservation, making them particularly suitable for organic and climate-resilient farming models.

Although several studies have addressed soil and climatic conditions for establishing new plantations, there is still no comprehensive and tested technology for hazelnut cultivation - either conventional or organic - adapted to local conditions. The relatively low production levels further emphasize the need for continued research and technological development. Existing data indicate that, while Bulgaria's hazelnut production remains modest compared with global leaders, there is active development and tangible potential. The existence of data on area, yield, and production trends provides a basis for further agronomic and economic analysis.

Future research and policy efforts should prioritise conducting field studies on commercial farms; developing technical guidelines for organic hazelnut production; and supporting the establishment of demonstration organic farms to showcase best practices and strengthen knowledge-exchange networks among producers and researchers.

References

AliNazee M.T. (1998). Ecology and management of hazelnut pests. *Annual Review of Entomology* 43, 395-419.

AliNiazee M.T. (1983). Pest status of filbert (hazelnut) insects): A 10-year study. *The Canadian Entomologist*. 115 (9), 1155 – 1162.

Aydogan,M., Demiryurek, K., Abaci, N., I. (2018). World hazelnut trade networks. *Acta Horticulure* 1226, 429–435.

Bacchetta, L., Rovira, M., Tronci, C. *et al.* (2015). A multidisciplinary approach to enhance the conservation and use of hazelnut *Corylus avellana* L. genetic resources. *Genet Resour Crop Evol* 62, 649–663. https://doi.org/10.1007/s10722-014-0173-7

Bartzas, G., Vamvuka, D., Komnitsas, K., (2017). Comparative life cycle assessment of pistachio, almond and apple production. *Information processing in agriculture* 4 (3), 188–198.

Blagoeva, E. (2020). Hazelnut production – current situation, issues and perspectives. *Rastenievadni nauki,* 57(1), 48-53.

Bobev S.G., Angelov L.T., van Poucke K., & Maes M. (2018). First report on kernel spot caused by *Eremothecium coryli* in Bulgaria. *Plant disease* 102 (1), 243.

Chambers, U., Walton, M., & Mehlenbacher, S. (2011). Susceptibility of Hazelnut Cultivars to Filbertworm, *Cydia latiferreana*. *Hortscinece* 46(10), 1377–1380.

Commission Implementing Regulation (EU) 2021/1165 of 15 July 2021 authorising certain products and substances for use in organic production and establishing their lists

Commission Implementing Regulation (EU) No 540/2011 of 25 May 2011 implementnig Regulation (EC) No 1107/2009 of the European parliament and of the Council as regards the list of approved active substances. (2011). Retrieved from https://eur-lex.europa.eu/eli/reg_impl/2011/540/oj/eng

Coppola, G., Costantini, M., Fusi, A., Ruiz-Garcia, L., & Bacenetti J. (2022). Comparative life cycle assessment of conventional and organic hazelnuts production systems in Central Italy. *Science of the Total Environment* 826 (9). https://doi.org/10.1016/j.scitotenv.2022.154107

Cristofori, V., Speranza, S., & Silvestri, K. (2019). Developing hazelnuts as a sustainable and industrial crop. In Serdar, Ü. and Fulbright, D. (eds.), *Achieving sustainable cultivation of tree nuts*, Burleigh Dodds Science Publishing, Cambridge, UK, ISBN: 978 1 78676 224 5;

Delgado T., Malheiro R., Pereira J. A, Ramalhosa E. (2010). Hazelnut (*Corylus avellana* L.) kernels as a source of antioxidants and their potential in relation to other nuts. *Industrial Crops and Products,* 32 (3), 621-626, ISSN 0926-6690 https://doi.org/10.1016/j.indcrop.2010.07.019.

Developments in Organic farming. (2025). Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Developments_in_organic_farming

EPPO Global database. (2025). Retrieved from https://gd.eppo.int

EU Farm to Fork Strategy. (2020). Retrieved from https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en

FAOSTAT. Agriculture Data. 2025. Available online: https://www.fao.org/faostat/es/#data/QCL (accessed on 20 October 2023).
Gantner M., & Jaśkiewicz B. (2002). Beetles (Coleoptera) occurring on hazel (*Corylus* L.) in different habitat conditions. *Acta Scientarum Polonorum, Hortorum Cultus* 1 (1), 55–66.
Gantner, M. J. (2001). Occurrence of hazelnut pests in southeastern Poland. *Acta Horticulturae*, 556 (556), 469-478, https://doi.org/10.17660/ActaHortic.2001.556.69
Gültekin, N. (2020). Leaf-litter inhabitant weevils (Coleoptera: Curculionidae) in a small forest refuge fragment among hazelnut orchards at Trabzon. *Int J Agric Environ Food Sci*. 4, 507–512.
Hedstrom, C. S., Shearer, P. W., Miller, J. C., & Walton, V. M. (2014). The effects of kernel feeding by *Halyomorpha halys* (Hemiptera: Pentatomidae) on commercial hazelnuts. *Journal of economic entomology*, 107(5), 1858-1865. https://doi.org/10.1094/PDIS-06-17-0839-PDN
Iliev, I., & Zdravkov, K. (1962). Hazelnut growing in Horticulture and Forestry. Zemizdat, Sofia (Bg).
İslam A, & Serdar Ü. (2020). Bahçe yerinin dikime hazırlanması ve fidan dikimi. In A. İslam (Ed.). Fındık Yetiştiriciliği. Yeşiller grafik tasarım reklam ve matbaacılık, I. Baskı, 52-77s, Fatsa, Ordu, Türkiye.
İslam A, Özkutlu F, & Tonkaz T. (2018). Hazelnut cultivation in Turkey. In A. İslam (Ed.). *Hazelnut cultivation in Europe*. MKB Halk Kütüphanesi Yayınevi Printed, 12-59, Yenibosna, İstanbul, Türkiye.
Ivanova, M. (2018). Pests of hazelnut and almond. *Plant Protection*, 5/2018, 22-25.
Karova, A. (2011). Organic agriculture in Bulgaria - current status, prospects and constraints to its further development. In *Climate change: Challenges and opportunities in agriculture : Agrisafe final conference* (pp. 414-417). Budapest, Hungary.
Karova, A., & Ilieva-Pencheva, T. (2024). Challenges and opportunities for utilizing ecosystem services in the sustainable management of agroecosystems. *Agricultural Sciences*, 43, Suppl., 64-71
Karova, A., Dzhabarova, Y. (2012). The development of legislation reveals additional opportunities for Bulgarian organic producers. In: Proceedings of the ninth national scientific conference with international participation “Ecology and Health” (pp. 213-218), Plovdiv, Bulgaria.
Kereselidze, M., Goderdzishvili, G., & Khidesheli, M. (2018). Monitoring damage caused by harmful pests in hazelnut orchards in Samegrelo region, Georgia. *ISHS Acta Horticulturae* 1226, 373-378
Kollár, J. (2007). The harmful entomofauna of woody plants in Slovakia. *Acta Entomol*. *Serbica* 12, 67–79.
Kolören, O. (2020). Yabancı ot ve mücadelesi. In A. İslam (Ed.) Fındık Yetiştiriciliği. Yeşiller grafik tasarım reklam ve matbaacılık, I. Baskı, 132-143s, Fatsa, Ordu, Türkiye.
Mehlenbacher, A. (1991). Hazelnuts (Corylus). *Acta Hortic.* 290, 791-838. https://doi.org/10.17660/ActaHortic.1991.290.18

Mercati, V., (2016). Organic agriculture as a paradigm of sustainability: Italian food and its progression in the global market. *Agric. Agric. Sci. Procedia*. 8, 798–802.
Minkova, I., Karova, A., Ilieva-Pencheva T. (2024). Role of regulating ecosystem services in reducing the use of chemical pesticides. *Agricultural Sciences*, 43, Suppl., 56- 63.
National Plan for the Development of Organic Farming until 2030. (2025). Retrieved from https://www.mzh.government.bg/bg/
Nedev, N., Vasilev, V., Kavardzhikov L., & Zdravkov, K. (1976). Nut crops. Hristo G. Danov, Plovdiv (Bg).
Nikolova, M. (2006). Influence of hazelnut training on its reproductive features. *Journal of mountain agriculture on the Balkans,* 9, (6), 1148-1156.
Nikolova, M. (2007). Production of hazel tree planting material in a nursery. Journal of mountain agriculture on the Balkans, 10, (5), 816-825.
nucum L. – Coleoptera, Curculionidae). Part I. Evaluationof the resistance of several cultivars. *Acta Agrobot*. 42 (1/2), 123–131.
Organic Farming Electronic Register. (2025). Retrieved from https://bioreg.mzh.government.bg/Home/DataBaseList
Özkutlu, F. (2020). Fındık bahçelerinde gübreleme. In A. İslam (Ed.). Fındık Yetiştiriciliği. Yeşiller grafik tasarım reklam ve matbaacılık, I. Baskı, 78-87s, Fatsa, Ordu, Türkiye
Pacchiarelli, A., Silvestri, C., & Cristofori, V. (2022). Advances in Sucker Control for Sustainable European Hazelnut (*Corylus avellana* L.) Cultivation. *Plants* 11 (24), 3416. https://doi.org/10.3390/plants11243416
Piskornik Z. (1989). The resistance of hazel (*Corylus avellana* L.) to hazelnut weevil (*Curculio*
Piskornik Z. (1992). Observation on the resistance of hazelnut (*Corylus avellana* L.) to the hazelnut weevil (*Curculio nucum* L. – Coleoptera, Curculionidae). *Acta Hort*., 317, 163–170.
Popov, V., & Karova, A. (2015). Development and prospects for organic agriculture in Bulgaria. Scientific works of the Agricultural University - Plovdiv, 3 (59), 9-17.
Program for Rural Development 2014-2020. (2020). Retrieved from https://www.mzh.government.bg/bg/
Register of PPP's in Bulgaria. (2025). Retrieved from https://bfsa.egov.bg/wps/portal/bfsa-web/registers/plant.protection.products
Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) no. 834/2007. (2018). Retrieved from https://eur-lex.europa.eu/eli/reg/2018/848/oj/eng
Roversi, A. (2016). Observations on hazelnut organic farming. *Bulgarian Journal of Agricultural Science*, 22 (2), 171–175
Ruşen, M., Tuncer, C., & Turan A. (2005). Fındık kurdu [*Balaninus (Curculio) Nucum* L. Colertera: Curculionidae)]'na karşı organik kökenli preparatlarla mücadele imkanlarının araştırılması. Tarım ve Köyişleri Bakanlığı,

Tarımsal Araştırmalar Genel Müdürlüğü, Fındık Araştırma Enstitüsü Müdürlüğü (Sonuç Raporu).
Şenol H. (2019). Biogas potential of hazelnutshells and hazelnut wastes in Giresun City. *Biotechnology Reports*, 24, 361
Sezer A. (2020). Fındık hastalıkları ve mücadelesi. In A. İslam (Ed.). Fındık Yetiştiriciliği. Yeşiller grafik tasarım reklam ve matbaacılık, I. Baskı, 96-113, Fatsa, Ordu, Türkiye.
Spiegel, A., Coletta, A., & Severini, S. (2022). The distortive effect of organic payments: An example of policy failure in the case of hazelnut plantation. *Land use Policy* 119, https://doi.org/10.1016/j.landusepol.2022.106202
Strategic plan for agriculture and rural development 2023-2027. Retrieved from https://www.sp2023.bg/index.php/en/
Turan A, Beyhan N, Sarıoğlu M, Memiş S. 2009. Organik fındık yetiştiriciliği. I. Organik Tarım Tongresi, 17-20 kasım 2009, Şanlıurfa, s: 809-816.
Turan, A. (2023). Organic Hazelnut Farming Techniques: A Review . *Turkish Journal of Agriculture - Food Science and Technology*, 11(4), 876–882. https://doi.org/10.24925/turjaf.v11i4.876-882.5923
Turan, A., & İslam, A. (2020). Fındığın ekolojik istekleri. In A. İslam (Ed). Fındık Yetiştiriciliği. Yeşiller Grafik Tasarım Reklam ve Matbaacılık, I. Baskı, 27-29s, Fatsa, Ordu, Türkiye.
Vlahova, V. (2020). The role of hazelnuts (*Corylus avellana* L.) for the sustainability of the agroecosystem. *New knowledge Journal of science*, *9*(4), 77-84.
Wojciechowicz-Żytko, E. (2003). Development of *Myzocallis coryli* Goetze (Homoptera, Aphidodea) on the different hazel (*Corylus* L.) cultivars. *J. Plant Protection Res*., 43, 369–374.
Wojciechowicz-Żytko, E. (2005). Infestation of hazel nuts by hazelnut weevil (*Curculio nucum* L., Coleoptera: Curculionidae) in Poland. *Journal of plant protection research*, 45 (2), 59-61