

# Research on the Cultivation Technology of Yam (*Dioscorea opposita*) in Northern China

Jintong LIU, Wenjia ZENG, Qiangtian LONG, Jiayi WANG, Yufei LI, Huiqin LIU\*

College of Horticulture and Landscape Architecture, Tianjin Agricultural University, Tianjin 300384, China

**Abstract** Yam (*Dioscorea opposita*) is an important economic crop, and the development of its the cultivation technology is of great significance for increasing yield, improving quality, and reducing the occurrence of pests and diseases. With the progression of agricultural technology and changes in market demands, the cultivation technology of yam is constantly innovating and improving. This paper reviewed recent research advances in yam cultivation technology, covering aspects such as soil improvement, variety selection, technological innovations, green pest control, and harvesting and storage. The goal is to provide references for the sustainable development of the yam industry.

**Key words** Yam; Cultivation; Management; Research progress

**DOI:**10.19759/j.cnki.2164-4993.2026.01.003

Yam (*Dioscorea opposita*), as one of the classic examples of a dual-purpose medicinal and edible plant, has a long cultivation history in China and is widely distributed across both northern and southern regions. Not only does yam earn widespread consumer favor for its rich nutritional value, but it also holds a significant place in traditional Chinese medicine due to its unique medicinal effects, such as alleviating night sweats, stopping diarrhea, aiding digestion, and providing nutrition<sup>[1]</sup>. Furthermore, as an important economic crop, the cultivation technology of yam directly influences its yield and quality. The advancement and innovation of its cultivation technology determine the future development prospects of yam. With the rapid progress of agricultural science and technology and increasing consumer attention to food safety, the research and application of yam cultivation technology also face new challenges and opportunities. This paper comprehensively reviewed recent research advances in yam cultivation technology, covering areas such as soil improvement, variety optimization, innovations in planting techniques, refined field management, green pest and disease control, as well as harvesting and storage methods, aiming to offer theoretical foundations and technical references for the sustainable development of the yam industry.

## Soil Improvement and Nutrient Management

### Soil characteristics and improvement

Yam has strict soil requirements and thrives only in deep, fertile, loose, and well-drained sandy loam or loam soils. Therefore, soil improvement is a primary task in yam cultivation. Before

planting, deep plowing of the soil is necessary to enhance soil structure and increase soil fertility. Meanwhile, rational fertilization is an essential aspect of soil management. Precision fertilization should be implemented based on soil nutrient conditions and the growth requirements of yam to ensure an adequate supply of essential nutrients. Research has shown that adding organic materials (such as well-rotted farmyard manure and green manure) and soil amendments such as lime can effectively improve soil structure, enrich soil microbial composition, and create favorable environmental conditions for yam growth. Additionally, in yam production, combining crop rotation with legumes and vegetables, as well as intercropping with green garlic and watermelon, is an effective measure for improving soil environment and controlling pests and diseases<sup>[2]</sup>.

### Nutrient management

Yam has a long growth cycle and requires a continuous and substantial supply of nutrients. Scientific fertilization is key to ensuring high yield, quality, and ecological sustainability in yam production. During fertilization, the principle of combining organic and inorganic fertilizers should be adhered to, and precise fertilization should be carried out based on soil nutrient conditions and the growth requirements of yam. Specifically, for basal fertilization, emphasis should be placed on the application of organic fertilizers to enhance soil fertility. For top-dressing, staged fertilization should be implemented according to the growth stages and nutrient requirements of yam to meet its nutrient demands at different growth phases. Meanwhile, balanced fertilization should be ensured to avoid excessive application of single elements, which could lead to soil nutrient imbalance and environmental pollution.

## Variety Optimization and Breeding

### Variety characteristics and selection

Yam encompasses a wide range of varieties including iron rod yam and purple yam. Different varieties exhibit variations in planting regions, growth habits, yield, quality, and stress resistance<sup>[3]</sup>.

Received: June 23, 2025 Accepted: November 15, 2025

Supported by Shandong Provincial Key Research and Development Program (2023TZXD034); 2024 National Undergraduate Innovation Training Program (202410061062).

Jintong LIU (2004 –), male, P. R. China, devoted to research about plant protection.

\* Corresponding author. Huiqin LIU (1973 –), female, P. R. China, professor, PhD, devoted to research about biological control of plant diseases.

Therefore, when selecting cultivation varieties, factors such as local climate conditions, soil conditions, and market demand should be comprehensively considered. In northern regions, varieties with strong cold tolerance, drought resistance, and disease resistance should be selected. In southern regions, emphasis should be placed on varieties that are heat-tolerant, humidity-tolerant, and high-yielding. Additionally, attention should be paid to consumer-focused characteristics such as appearance quality, texture, and flavor of the varieties.

### **Variety breeding and improvement**

With the rapid advancement of biological breeding technologies, significant progress has been made in the breeding and improvement of yam varieties. A number of new yam varieties characterized by high yield, superior quality, and strong resistance to pests and diseases have emerged, injecting new vitality into the development of the yam industry. Through methods such as hybrid breeding, mutation breeding, and genetic engineering, new varieties with high yield, excellent quality, and strong disease resistance can be developed. For example, hybrid breeding techniques can combine the desirable traits of different varieties. Mutation breeding techniques can produce mutants with novel characteristics. And genetic engineering techniques allow direct modification of the genetic material of yam to achieve targeted breeding. The application of these technologies provides strong support for the renewal and improvement of yam varieties<sup>[4]</sup>.

## **Innovations in Planting Techniques**

### **Sowing and seedling cultivation**

Sowing and seedling cultivation are critical steps in yam cultivation process. Traditionally, yam is often sown directly, but this method suffers from issues such as low germination rates and uneven growth. In recent years, with the continuous development of seedling cultivation techniques, an increasing number of farmers have adopted the approach of transplanting seedlings for yam cultivation. By conducting seedling cultivation in greenhouses in advance, yam seedlings can grow under optimal temperature and humidity conditions, improving both germination rates and growth speed. Additionally, transplanting time can be flexibly scheduled based on market demand and cultivation plans, enabling off-season cultivation and year-round supply of yam.

Yam planting techniques encompass aspects such as sowing methods, sowing time, planting density, among others. Appropriate sowing time and methods ensure successful germination and rapid growth of yam. Planting density directly affects both yield and quality. Excessive density or spacing can be detrimental to yam growth.

### **Cultivation methods**

Currently, the main cultivation methods for yam include trench digging, plastic casing, and mechanical hole drilling<sup>[5]</sup>. Among these, the trench digging method is the most widely used. In trench digging cultivation, manual excavation of trenches is the primary approach, which is supplemented by irrigation during

harvest. Generally, for yam cultivation, it is better to dig trenches with a depth of 80 – 100 cm, a row spacing of 80 – 100 cm and an average width of 20 – 25 cm. Depending on specific planting requirements, such as different yam varieties or regional conditions, trench depth and row spacing should be adjusted appropriately. Furthermore, with the development of facility agriculture, greenhouse cultivation has gradually been applied to yam production, offering new possibilities for yam cultivation. Currently, research on soilless cultivation of yam has achieved significant progress in recent years. As an efficient agricultural production method, it aligns with the principles of green agriculture, enhances farmers' economic benefits, and holds broad prospects for the future. With the continuous advancement of technology, soilless cultivation techniques for yam will continue to be refined and promoted. This will not only enhance the yield and quality of yam, but also further promote the modernization and scientific development of medicinal herb cultivation<sup>[6]</sup>. Future research can delve deeper into aspects such as nutrient solution formulations, cultivation substrate selection, and pest and disease control in soilless cultivation to improve the efficiency and stability of the cultivation technology. Meanwhile, efforts can be made to strengthen the integration of soilless cultivation technology with modern agricultural technologies, such as intelligent irrigation systems and soil monitoring technologies. This would enable precise and intelligent management in yam cultivation, contributing to the sustainable development of the yam industry and enhancing its market competitiveness.

### **Planting density and methods**

Planting density and methods significantly impact the yield and quality of yam. An appropriate planting density ensures that yam plants make full use of light, water, and nutrient resources, thereby enhancing overall photosynthetic efficiency. It also improves the local microclimate in the field and reduces the incidence of pests and diseases. In practical cultivation, factors such as variety characteristics, soil conditions, and product application value should be considered to determine suitable planting density and methods. For example, in regions or plots with favorable climatic and soil fertility conditions, planting density can be appropriately increased. On plots where water-saving irrigation techniques such as plastic film mulching or drip irrigation are employed, a wide-row and narrow-plant spacing approach can be adopted to improve land use efficiency and yield levels.

### **Field management**

Field management is an indispensable part of the yam cultivation process. It includes various aspects such as intertillage and weeding, irrigation and drainage, and trellising and vine training. Intertillage and weeding help loosen the soil, improve aeration, reduce pests, and promote root growth. Irrigation and drainage should be carried out timely and appropriately based on yam growth needs and soil moisture conditions to prevent drought or waterlogging. Trellising and vine training ensure proper distribution of yam vines, enhance photosynthetic efficiency, and reduce the incidence of pests and diseases. Furthermore, regular field

inspections should be strengthened to promptly identify and address pest and disease issues, as well as to implement growth regulation and quality enhancement measures. This ensures the healthy growth of yam, leading to high yield and superior quality.

## Green Pest and Disease Control

### Types and occurrence patterns of pests and diseases

During its growth process, yam is highly susceptible to attacks from various pests, diseases, and weeds. These harmful organisms not only affect the yield and quality of yam, but also reduce its commercial value and weaken its market competitiveness.

**Yam diseases** Common diseases affecting yam include anthracnose, brown spot, and root-knot nematodes<sup>[7]</sup>. The leaves and stems of yam are the primary sites for anthracnose infection, starting as small yellow-white lesions that eventually expand into irregular diseased patches. Brown spot mainly affects yam leaves, causing yellow-white spots that later enlarge into brown patches. Root-knot nematode disease is a persistent soil-borne disease affecting yam, primarily caused by several nematode species such as *Meloidogyne javanica*, which infect yam tubers and roots, forming nodular galls. Under conditions of continuous rainy weather and excessive irrigation, it can easily lead to widespread outbreaks and is difficult to eradicate completely.

**Yam pests** Yam is susceptible to a variety of pests, including borers, aphids, mirid bugs, and multiple underground pests<sup>[8]</sup>. Yam borers are among the most common pests. They enter the plant through leaves and stems to damage its growth. Yam aphids are another common pest, feeding on the sap of yam leaves, leading to leaf yellowing and withering. Mirid bugs, in both nymph and adult stages, pierce and suck the sap from the tender parts of yam plants, affecting their growth and development and causing significant losses. Underground pests, such as white grubs, mole crickets, and wireworms, primarily damage yam by having their larvae and adults bore into the roots and near-ground stems of the plants. This leads to yellowing and wilting of leaves, and in severe cases, even results in lack of seedlings and vacancy rows.

Therefore, understanding the types and occurrence patterns of yam pests and diseases is the foundation and prerequisite for developing effective control strategies. In actual production, through conventional methods combined with modern network and digital technologies, field surveys and pest prediction and forecasting are carried out to accurately monitor the occurrence dynamics and epidemic trends of pests and diseases, enabling timely implementation of control measures.

### Green control techniques

For the prevention and control of yam pests and diseases, the principle of "prevention first, integrated control" should be adhered to. It involves combining green integrated control technologies such as biological control, ecological regulation, and cultivation management to reduce the use of chemical pesticides. This approach enhances the quality and safety of yam while minimizing environmental pollution and damage. Among these, agricultural

control primarily involves selecting disease-resistant varieties, implementing reasonable crop rotation and intercropping, and strengthening field management to create a favorable ecological environment for yam growth. It enhances the vigor and pest and disease resistance of yam, thereby reducing the occurrence of pests and diseases. Biological control uses a range of biological agents, such as natural enemy insects including ladybugs and parasitic wasps, as well as microbial agents including *Bacillus* spp., to manage the occurrence and spread of pests and diseases. Ecological regulation involves using physical factors such as light, heat, electricity, temperature, and humidity to eliminate pests and diseases and regulate the growth environment within a certain range. Chemical control is adopted when necessary. It uses efficient, low-toxicity and low-residue green pesticides. However, strict control over dosage and frequency of application, as well as rotating the use of different pesticides, is essential to avoid environmental and product contamination and to prevent pests from developing resistance.

## Harvesting and Storage Techniques

### Harvest time and methods

The time of yam harvesting significantly impacts both yield and quality. Generally, harvesting can begin when the above-ground part of yam have withered or the stems start to age. Harvesting should ideally be carried out on sunny days to prevent rot and damage that may occur if harvested during rainy periods or when the soil is excessively wet. During harvesting, methods such as manual digging or mechanical harvesting are adopted to extract yam from the soil. The harvested yam should then be cleaned of soil and impurities, followed by grading, packaging, and storage.

### Storage techniques

During storage, yam is prone to issues such as rot, discoloration, and water loss, which can affect its commercial value and edible quality. Therefore, scientific and rational storage techniques should be adopted to extend the storage period and maintain stable quality. Before storage, yam should undergo cleaning, sun-drying, and grading to reduce surface moisture and the quantity of pathogens. During storage, suitable temperature and humidity conditions should be maintained, and regular inspections should be conducted to promptly identify and address any rotting or deteriorating yam. Additionally, techniques such as controlled atmosphere storage and preservative treatments can be conducted to further enhance storage effectiveness and market competitiveness<sup>[9]</sup>.

## Conclusions and Prospects

The development of yam cultivation technology involves multiple aspects, including soil improvement and nutrient management, variety optimization and breeding, innovations in planting techniques, green pest and disease control, and harvesting and storage techniques. Through continuous research and practice, we can steadily enhance the yield and quality of yam to meet market demands and promote the sustainable development of the yam

industry. In the future, with further advancements in agricultural technology and increasing consumer attention to food safety, we should strengthen the innovation and application of yam cultivation techniques. Particularly, breakthroughs are needed in areas such as intelligent management, precision fertilization, and green pest control to drive the yam industry toward higher levels of development. Meanwhile, we should also enhance exchanges and cooperation with other countries and regions to jointly promote the prosperity and development of the global yam industry.

## References

- [1] LI X. A brief analysis of the edible value and medicinal functions of yam (*Dioscorea opposita* Thunb.) [J]. China Food Safety Magazine, 2021 (6): 41–42.
- [2] WU KN, ZHOU XG, LIU CL, *et al.* Effects of soil species on the quality of *Dioscorea Opposita* Thunb. [J]. Chinese Journal of Soil Science, 2006 (6): 1098–1101.
- [3] LI MQ. A Comparative study on morphology, quality, and yield of yam

- (*Dioscorea opposita* Thunb.) varieties from different regions in Inner Mongolia[D]. Hohhot: Inner Mongolia Agricultural University, 2023.
- [4] TANG J, DAI XL, TU YQ, *et al.* Collection, identification and improvement of yam germplasm resources [J]. Acta Agriculturae Jiangxi, 2016, 28(10): 15–18.
- [5] CHEN TC. Preliminary study on shallow soil cultivation technology of yam (*Dioscorea opposita* Thunb.) with film mulching [J]. Agriculture and Technology, 2012, 32(11): 75–76.
- [6] SONG YH, SUN JF, XU LG, *et al.* Soilless cultivation technology for yam (*Dioscorea opposita* Thunb.) [J]. Northern Horticulture, 2018 (17): 206–207.
- [7] CHEN J. Common diseases and control techniques in yam cultivation[J]. Modern Agriculture, 2021(7): 22.
- [8] GUO ZY, LIU SJ, ZHAO S, *et al.* Identification and control of pests and diseases in yam (*Dioscorea opposita* Thunb.) [J]. Rural Scientific Experiment, 2013(4): 15.
- [9] WANG CL, LIU SJ, JIAO J. Storage, preservation, and primary processing techniques for yam (*Dioscorea opposita* Thunb.) [J]. Nongcun Xin Jishu, 2022(10): 61–62.

Editor: Yingzhi GUANG

Proofreader: Xinxiu ZHU

(Continued from page 8)

research thinking were organically integrated, driving a shift in the curriculum from basic tool operation to comprehensive practical ability development. Teaching practice has demonstrated that this model effectively enhances students' bioinformatics analysis skills and practical application capabilities, showing strong adaptability and potential for wider implementation in local universities. Going forward, the teaching team will continue to refine its focus on applied competencies, diversify course content, and enhance teaching methods. The ultimate goal is to establish a sustainable and replicable teaching model for local universities to cultivate bioinformatics talents with comprehensive applied capabilities.

## References

- [1] CHEN M. Integrative bioinformatics in the big data era[J]. Chinese Journal of Bioinformatics. 2022, 20(2): 75–83. (in Chinese).
- [2] ROOD J E, MAARTENS A, HUPALOWSKA A, *et al.* Impact of the Human Cell Atlas on medicine[J]. Nature Medicine. 2022, 28(12): 2486–2496.
- [3] SUN L, ZHU C. Bioinformatics applications in the analysis, modification and de novo design of interacting proteins[J]. China Biotechnology, 2025, 45(7): 43–58. (in Chinese).
- [4] GIORDANI L, HE GJ, NEGRONI E, *et al.* High-dimensional single-cell cartography reveals novel skeletal muscle-resident cell populations[J].

- Molecular Cell, 2019, 74(3): 609–621.
- [5] CHEN M. The development of bioinformatics discipline and talent cultivation mode in the era of artificial intelligence[J]. Frontiers. 2024(16): 21–27. (in Chinese).
- [6] ZHANG XY. Rethinking the undergraduate bioinformatics curriculum [J]. China University Teaching, 2018(3): 37–39. (in Chinese).
- [7] YI JC. Exploration on the teaching of bioinformatics course in biology specialty—teaching reform practice and thoughts on bioinformatics course in biology specialty in South China Agricultural University[J]. Journal of Anhui Agricultural Sciences, 2018, 46(26): 231–233. (in Chinese).
- [8] JJINGO D, MBOOWA G, SSERWADDA I, *et al.* Bioinformatics mentorship in a resource limited setting[J]. Briefings in Bioinformatics. 2022, 23(1): bbab399.
- [9] DONG SS, GUO Y, YANG TL. Generative AI-assisted project-based learning of Python for biology majors[J]. Journal of Biology, 2025, 42 (4): 27–30. (in Chinese).
- [10] WANG YM, KONG L, ZHANG J, *et al.* Exploration of the ideology and politics education model in medical molecular biology courses based on outcome-oriented behavior concept and integration of project-based group study[J]. Chinese Journal of Biochemistry and Molecular Biology, 2024, 40(11): 1636–1648. (in Chinese).
- [11] TANG WW, WU XL. The flipped class application with MOOC in bioinformatics course [J]. Journal of Zhaoqing University, 2015, 36 (2): 63–66. (in Chinese).

Editor: Yingzhi GUANG

Proofreader: Xinxiu ZHU