Common Diseases and Insect Pests in Garlic Planting and Control Strategies

Shijie Wang, Xiang Liu, Xiaomeng Shi, Rongfang Feng^a

Faculty of Applied Technology, Huaiyin Institute of Technology, Huaian 223001, China

^afrffrffrf@163.com

Abstract

Garlic, as an important seasoning and medicinal plant, has witnessed a rapid development in its cultivation in recent years. However, with the increase of large-scale planting, some disease and pest problems have become increasingly prominent, posing a challenge to the economic benefits of growers. Common diseases of garlic include leaf blight and bacterial soft rot, while the main pest is the garlic maggot. These diseases and pests not only affect the growth of garlic but also may lead to a significant decline in its yield and quality. To address this challenge, growers need to take a multi-faceted approach and adopt a series of integrated control measures. For instance, choosing varieties with strong disease resistance, strictly implementing crop rotation, and applying appropriate pesticides are all necessary. In practical operations, it is also essential to closely monitor environmental changes during the growth period of garlic, such as temperature and humidity, as these factors can also influence the occurrence of diseases and pests. In conclusion, through scientific planting management and comprehensive control measures, the yield and quality of garlic can be maximized, ensuring the economic benefits of growers.

Keywords

Garlic; pests and diseases; control srategies; planting.

1. Introduction

In recent years, with the continuous expansion of garlic planting areas, especially under the background of multiple consecutive years of monoculture in some regions, the problem of garlic pests and diseases has become increasingly serious and has become an important factor restricting the development of the garlic industry[1]. To promote the development of green agriculture and ensure the healthy and sustainable development of the garlic industry, it is necessary to explore strategies for the prevention and control of garlic pests and diseases[2].

First of all, we need to conduct an in-depth analysis of the causes of garlic pests and diseases. Through quality variety selection, garlic field control, pharmaceutical control and field management and other measures, can be targeted to prevent and control pests and diseases. For example, the selection of garlic varieties with strong resistance to diseases and pests, as well as agronomic measures such as reasonable crop rotation and scientific fertilization, can effectively reduce the occurrence of diseases and pests[3].

Secondly, comprehensive application of agricultural control, biological control, physical control, chemical control and other methods to implement comprehensive disease and pest control[1]. In terms of agricultural control, through reasonable adjustment of planting structure and reasonable crop rotation, the life cycle of diseases and pests can be interrupted and the source of diseases and insects can be reduced. Biological and physical control can be targeted to eliminate pests and diseases, and is friendly to the environment. Of course, when necessary,

chemical control is also an important means, but it must be strictly in accordance with the principle of safe use to avoid pollution to the environment and the human body.

Thirdly, for the sustainable development of agriculture, it is very necessary to implement the green plant protection and modern plant protection policy of "prevention first, comprehensive prevention and control"[2]. By doing a good job of plant protection, it can better realize the prevention and control of diseases and pests, reduce the use of chemical pesticides, and reduce the impact on the environment.

Finally, special attention is needed for specific pests and diseases, such as stem rot, leaf blight, bacterial soft rot, etc[1]. For example, the prevention and control of stem rot requires special attention to prevent the impact of excessive precipitation, sticky soil and other environmental factors, and reduce its impact on garlic growth through reasonable field management and timely prevention and control measures.

In conclusion, the exploration of garlic pest prevention and control strategy requires not only the comprehensive use of various prevention and control methods, but also prevention and management from the source, in order to achieve green and sustainable development of the garlic industry.

2. Common diseases in garlic planting

Garlic is susceptible to a variety of diseases during growth, such as disease, white rot, rust, soft rot and so on. There are many kinds of pathogenic bacteria in garlic diseases. According to the different characteristics of pathogenic bacteria, they can be divided into fungal, bacterial and viral categories[4]. Understanding the biological characteristics and transmission routes of these pathogens is of great significance for effective prevention and control of garlic diseases. Through understanding the physiological characteristics of pathogenic bacteria such as growth temperature, pH preference and humidity demand, it can provide scientific basis for disease control in agricultural production.

Fungal diseases are one of the main diseases of garlic, such as white rust and black spot[4]. White rust is mainly caused by fungi and manifests as white mycelium on the leaves. Garlic black spot is characterized by round or irregular black spots on the leaves. These diseases will not only reduce the yield of garlic, but also seriously affect the quality of garlic[4].

Bacterial diseases, such as garlic soft rot, are mainly caused by some bacteria that can cause soft rot in plant tissues[5]. The occurrence of this disease is closely related to environmental conditions, such as continuous rainfall, poor drainage, suitable temperature and so on are favorable conditions to induce this disease. Infected plants will appear yellow and white stripes, the disease will run through the leaves of the entire garlic plant, and in severe cases will cause the plant to wither and die.

Viral diseases are caused by viruses, such as the garlic cucumber Mosaic virus, which is spread primarily by aphids, which can transmit the virus to healthy garlic plants, causing slow growth and yellowing of the leaves[6]. In addition, infected garlic seeds, diseased plants in the field, infected bulbs left over from previous crops, and strains from neighboring crops are also routes of virus transmission. Once the garlic cloves with poison are sown, the emergence of seedlings may occur, resulting in a smaller garlic head and a reduction of 20% to 50%.

Garlic rust is a kind of disease which has great influence on the growth of garlic[7]. The disease mainly attacks the leaves, and in severe cases affects the false stem, resulting in small garlic head, easy to crack loose, and significantly reducing the commodity value of the product. Garlic rust not only affects the yield and quality of garlic, but also may overwinter on retained scallions and overwintering scallions through summer spores, and infect garlic again in the next summer, especially in the critical period of rapid growth of garlic. The occurrence of garlic rust is closely related to the climatic conditions in spring. When rainfall increases from March to April, the

temperature rises rapidly and the air humidity is high, the incidence and harm of the disease will increase significantly. The morbidity and harm degree are more serious in the plots with high water table, heavy soil and low-lying land[7].

Comprehensive measures such as continuous disease management, optimization of planting environment and selection of resistant varieties are essential to control the occurrence of diseases such as garlic rust. Common control methods include spraying with pesticides such as Bordeaux solution, Chlorothalonil, and carbendazim, and usually require 2 to 3 treatments to ensure effectiveness[8]. In addition, in order to effectively prevent and control other diseases and pests transmitted by aphids, it is also necessary to spray pyrethroid pesticides every 5 days after the garlic shoots return to green, and continuously treat 2 to 3 times.

3. Common insect pests in garlic planting

During the growth of garlic, aphids are a common pest and disease, and there are threats such as underground pests, which can adversely affect the healthy growth of garlic. In the whole process of garlic growth, aphids and underground pests have different activity rules and conditions, but they all have a common feature, that is, great harm to garlic.

The symptoms of aphids usually appear as many small aphids on the opposite side of garlic leaves. These bugs will suck up the juice of the garlic, causing the tips of the leaves to turn yellow or die, and in severe cases, the growth of the whole plant will be affected. The occurrence of aphids is mainly related to environmental conditions, such as temperature, humidity, etc., especially in the environment with high humidity and suitable temperature, the reproduction and growth of aphids is more serious.

Underground pests mainly refer to garlic maggots and other stem insects, they are mainly active in the roots and stems of garlic, especially after the garlic seedlings return to green, these pests are more powerful[9]. The occurrence of underground pests is mainly in spring and early summer, and the temperature and humidity conditions in these two seasons are very suitable for their growth and reproduction. They will lay their eggs in cracks or clods of soil, and after a period of incubation, the small insects will eat into the garlic stem, causing the garlic to die.

Garlic is affected by these pests, which will not only affect its growth, but also greatly reduce its yield and quality. For example, the absorption effect of aphids will lead to insufficient nutrient supply of garlic, affecting its normal growth and development; The underground pests will cause the garlic stem to be destroyed, and even the whole plant of garlic will die in serious cases, which has a direct impact on farmers' economic income.

4. Occurrence rule of common diseases and insect pests in garlic planting

4.1. Occurrence rule of common diseases in garlic planting

In the course of garlic planting, because of the concentrated planting and repeated cropping, garlic leaf blight occurred seriously. Generally speaking, the disease begins to appear in March every year, and reaches its peak between April and May, the incidence area can reach 6000 hectares, the incidence rate is generally 50% to 70%, and in some cases even 100%[10]. In addition, the occurrence of gray mold and sclerotium is closely related to the rainfall from April to May, and heavy rainfall and foggy weather will significantly exacerbate the occurrence of these two diseases.

The manifestations of garlic after infection are various, such as bacterial soft rot usually starts from the edge of the leaf, then gradually expands to the entire leaf, and appears yellow brown soft rot when the humidity is high, and eventually leads to the entire plant wilting and death[11]. This disease is more serious in the environment of low temperature and high humidity, especially in low-lying land with poor drainage, and its incidence is significantly increased[12].

In general, the disease starts in November, and is relatively rare in years with little rain and drought.

In the prevention and control of garlic diseases, the selection of high-quality varieties, reasonable field management and pharmaceutical control are the key measures to ensure the healthy growth of garlic[3]. However, with the increase of planting years, due to the continuous deterioration of the cultivation ecological environment, the resistance of garlic is gradually reduced, making the occurrence of diseases and pests increasingly serious, which brings greater challenges to farmers[13].

In summary, the occurrence of garlic diseases has obvious seasonal and environmental characteristics, and is also closely related to the quality of planting management. Therefore, in order to reduce the frequency of pests and diseases and reduce their impact on the growth and yield of garlic, comprehensive measures should be taken from variety selection, field management, pharmaceutical control and other aspects to ensure the healthy growth of garlic and the economic benefits of farmers.

4.2. Occurrence rule of common insect pests in garlic planting

The occurrence of garlic pest is affected by many factors, among which natural factors and human factors are the two main categories [4]. Natural factors include climatic conditions and soil type, which have a decisive influence on the distribution and severity of pests. For example, a high humidity environment is conducive to the occurrence of fungal diseases, while a dry environment may promote the activity of certain aphids. Soil pH value, organic matter content and drainage performance also affect the living environment of pathogens and pests, and thus affect the health of garlic[14]. Human factors mainly involve the management measures of farmers, such as variety selection, pharmaceutical control and field management, which have a direct impact on the healthy growth of garlic and the occurrence of insect pests[3].

With the increase of planting years, the cultivation ecological environment may gradually deteriorate, and the resistance of garlic may also decline year by year, resulting in increasingly serious diseases and pests, and the loss will also increase. In addition, the life cycle and activities of some specific pests, such as root mites, can also have an impact on the health of garlic. Root mites usually live in the rhizomes of garlic and can reproduce many times a year, and the breeding season is mostly after the temperature rises, which is the most frequent activity and the main period of damage to garlic.

5. Control strategies of common disease and insect pest in garlic planting

5.1. Biological prevention and control

n recent years, with the development of garlic planting industry, the problem of disease and pest is becoming more and more prominent[1]. In order to ensure the yield and quality of garlic and ensure the sustainable development of the environment, the research and application of biopesticides have received extensive attention. Biopesticide refers to the use of organisms in nature or their metabolites as raw materials, through biotechnology methods to develop products with pesticide functions. They minimize the use of chemical pesticides mainly through the biological control of pests and diseases, so as to achieve the safety and environmental friendliness of pesticide use.

In the production of garlic, examples of application of biopesticides include the use of *Bacillus thoringiensis* (Bt), *Bacillus subtilis*, Jinggangmycin, avermectin, *Beauveria bassiana*, Ningnanmycin and other microbial preparations to control garlic leaf blight, white rot, viral disease, maculata fly, cabbage moth and other diseases and pests. These biopesticides have the characteristics of high efficiency, low toxicity and environmental protection, and can effectively control the occurrence and development of diseases and pests without polluting the

ISSN: 1813-4890

environment. Bacillus thuringiensis (Bt), for example, is an important microbe that is widely used in biopesticides and has specific effects on certain lepidoptera pests. In the cultivation of garlic, Bt can effectively control the occurrence of insect pests such as onion seed flies (garlic maggots)[9]. Similarly, jinggangmycin and Ningnanmycin are also widely used in the field of biological pesticides microbial products, they can be used to control a variety of diseases of garlic.

When using biopesticides, we should not only pay attention to the selection of agents and dose control, but also pay attention to the method and timing of use. In general, the use of biopesticides should be carried out at the early stage of the occurrence of pests and diseases to ensure the maximum control effect. At the same time, because the speed and scope of biological pesticides may be different from chemical pesticides, the use of biological pesticides should also take into account the local climate conditions, the occurrence of diseases and pests and other factors, in order to develop a more scientific control strategy.

In short, biopesticides play an important role in the pest control of garlic and other specialty crops with their safety and environmental protection characteristics. In the future, with the continuous progress and optimization of biotechnology, the application scope and effect of biopesticides will be further improved, and greater contributions will be made to the realization of green and sustainable agricultural production.

5.2. Field management

In order to effectively prevent and manage various diseases and pests in garlic fields, we need to optimize the planting system and improve soil conditions. First, maintaining the proper moisture and temperature of the soil is fundamental. Garlic has a high demand for water and nutrients, and regular watering and fertilization can not only ensure its growth needs, but also improve its disease resistance by improving the structure of the soil. Especially in the seedling and maternal period, the growth rate of garlic is slower in these two periods, and it is necessary to appropriately increase the amount of fertilization and watering[9].

For common pests and diseases, such as leaf blight, viral disease, blight and garlic maggots, in addition to using chemical agents for control, the incidence of pests can be reduced by improving field management[15]. For example, for leaf blight, the breeding of bacteria can be reduced by strengthening field management, reasonable close planting, and timely drainage after rain[16]. For the control of garlic maggots, you can choose the right agent combined with watering to irrigate the root, so that it can effectively kill insects, but also to avoid the pollution of the agent to the environment[17].

In terms of improving soil conditions, proper application of organic materials can provide more nutrients and improve soil structure. For some soil-borne diseases, such as white rot and sclerotium, the pathogen can be reduced by spreading wood ash or gypsum powder at the base of the stem[18]. In addition, appropriate topdressing is also necessary, such as in the garlic mother dry shrinkage period, garlic bolting period and scale-bud expansion period, potassium sulfate can be applied to promote the growth of garlic and improve its disease resistance[18].

In order to ensure the growth quality and food safety of garlic, we should strictly control the type and amount of drugs used, prohibit the use of illegal vegetable drugs, and regularly monitor farmland in order to find and solve possible problems in time. Through the above integrated management measures, the diseases and pests in the garlic field can be effectively controlled, and the output and quality of garlic can be guaranteed.

5.3. Prevention and control technology

As an important cash crop, garlic is vulnerable to leaf blight, white rot, rust and other diseases, as well as garlic maggots and other pests during its growth [19]. In order to ensure the healthy

ISSN: 1813-4890

growth and yield of garlic, scientific control measures are essential. In general, the technical means of pest control include agricultural control and chemical control.

Agricultural control mainly reduces the occurrence of diseases and pests by improving the growing environment, enhancing the resistance of plants to diseases and insects and enhancing biodiversity. Common practices include selection of resistant varieties, rational crop rotation, increased application of organic matter, timely irrigation to control humidity and moisture, and timely removal of diseased plant residues[19]. These measures can effectively reduce the probability of pests and diseases, but also help to improve soil fertility and improve soil structure, thereby improving the overall health of garlic.

Chemical control is the use of chemical pesticides to directly kill or inhibit the occurrence and development of pests and diseases. Common chemicals include carbendazim, chlorothalonil, tetrachlorfon, and phoxium. In actual operation, appropriate agents and methods of use should be selected according to the types of diseases and pests, the degree of occurrence and climatic conditions. For example, for leaf blight, carbendazim can be used for seed treatment before sowing, and when the disease has developed to a certain extent, chlorothalonil is needed for spray treatment to control the spread of the disease [19]. For the allium thrips and garlic maggot and other pests, you can use phoxius or trichlorfon and other agents for control.

Combining the above two prevention and control methods, it is usually necessary to formulate a reasonable prevention and control plan according to the specific situation. On the one hand, it is necessary to reduce the occurrence base of diseases and pests through agricultural control, and on the other hand, chemical control measures should be taken in time when necessary to quickly and effectively control the spread of diseases and pests[19]. It should be noted that chemical control should be carried out in strict accordance with the instructions for use to avoid drug damage and environmental pollution caused by excessive use. At the same time, the rational deployment and use of pesticides can not only achieve better control effects, but also reduce the impact on the environment and achieve sustainable development.

In short, the control of garlic pests and diseases needs to use a variety of technical means, through the combination of agricultural control and chemical control, comprehensive consideration of time, place, climate and other factors, scientific development of control strategies, in order to achieve the best control effect.

6. Conclusion and planting suggestions

Garlic is an important cash crop, but it is vulnerable to various pests and diseases in the production process, which has adverse effects on the growth and development, yield and quality of garlic. These diseases and pests not only affect the normal growth of garlic, but also may affect the normal physiological function of garlic through various ways, resulting in the deterioration of garlic seed, yield and quality. The control of garlic pests and diseases is a systematic project, which needs to start from many angles and use various control methods comprehensively. Through continuous research and exploration, combined with the development of modern agricultural technology, it is expected to find a more scientific, environmentally friendly and efficient garlic pest control program to ensure the sustainable development of the garlic industry.

The development of garlic farming industry is facing serious challenges, especially in pest control. In order to improve garlic production and quality, the key issues and recommendations that require further research are as follows:

First of all, for the control of garlic pests and diseases, especially garlic maggots, it is necessary to further study and improve the comprehensive control strategy[9]. At present, although chemical control is effective, long-term use will affect the environment and human health, so it is the future development direction to explore environmental biological control and physical

control methods[9]. For example, by introducing natural enemies such as parasitic wasps to control the population of garlic maggots, or by using equipment such as physical traps to catch adults and reduce their reproduction of garlic maggots.

Secondly, in view of the aggravation of diseases and pests caused by repeated cropping of garlic, rotation system should be promoted to reduce continuous cropping obstacles. Through scientific planning of planting structure and implementation of crop rotation with other crops, the life cycle of pests and diseases can be effectively interrupted and the number of pest populations can be reduced.

Thirdly, the choice of high-quality varieties of garlic is also the key to improve yield and quality[3]. The natural resistance of garlic should be enhanced through variety improvement and selection of varieties with strong resistance to pests and diseases, and the dependence on pesticides should be reduced. At the same time, strengthening the control and field management of garlic fields, such as reasonable fertilization, timely irrigation, etc., can also effectively prevent the occurrence of diseases and pests.

In addition, the control of garlic pests and diseases also needs to strengthen scientific information guidance and technical training. Through the organization of professional technical training, farmers' awareness of disease prevention and pest control and operational skills are improved, so that they can flexibly use various control methods according to the actual situation, and improve the control effect.

Finally, scientific research on garlic pest control should be strengthened, especially on biological control and physical control methods, in order to find more environmentally friendly and more efficient control means[9]. At the same time, through the establishment of a sound disease and pest monitoring and early warning system, real-time grasp of the occurrence of diseases and pests, to provide a scientific basis for timely and effective prevention and control.

Acknowledgements

This study was supported by Jiangsu Innovation and entrepreneurship project of college students No. 202411049040Z.

References

- [1] Xu J, Huang S X. Common Diseases and Pest Control Techniques in Garlic Cultivation [J]. Hebei Agriculture. 2024, 351: 71-72.
- [2] Wang W. Green Food Garlic Cultivation Methods [J]. Friends of Farmers to Get Rich. 2011, 410: 32.
- [3] Wang Y D. Cultivation Techniques of Green Food Garlic []]. Shanxi Agriculture (Wealth Technology). 2008, 228: 34.
- [4] Cen J J. Exploration of Green Pest Control Techniques for Garlic Diseases, Pests, and Weeds in Qixian County [J]. Henan Agriculture. 2024, 689: 45-46.
- [5] Zhang Y C. Non-Polluting Production Disease and Pest Control Techniques for Garlic in Luohe City []]. Henan Agriculture. 2007, 179: 24.
- [6] Tao W C. Comprehensive Pest Control Techniques for Garlic Diseases, Pests, and Weeds in Central Shandong Region [J]. Jilin Vegetables. 2011, 144: 40-41.
- [7] Han C. Large-Scale Cultivation Management and Key Pest Control Techniques for Garlic [J]. Modern Agricultural Science and Technology. 2014, 635: 98-100.
- [8] Jiang C R. Research and Application of Key Green Pest Control Techniques for Garlic Diseases [J]. Rural Practical Technology. 2025, 278: 104-105.
- [9] Ni S P. Comprehensive Analysis of Key Points for Garlic Disease and Pest Control []]. Seed Science and Technology. 2021, 323 (39): 97-98.
- [10] Wan C Y, Ding H L, Liu S H, et al. Occurrence and Control Techniques of Garlic Diseases []]. Hubei Plant Protection. 2019, 174: 39-40.

ISSN: 1813-4890

- [11] Li Z, Qiao L C, Xue G S, et al. Analysis of Garlic Cultivation and Management Techniques [J]. Seed Science and Technology. 2018, 252 (36): 64-65.
- [12] Feng Y P, Kong H, Gao F R. Garlic Diseases and Comprehensive Control Techniques in Jining Area[J]. Modern Agricultural Science and Technology. 2009, 504: 104-108.
- [13] Zhang L Z, Wang H J, Xu W Y, et al. Current Situation, Countermeasures, and Equipment Selection Suggestions for Full Mechanization of Garlic Production [J]. Hebei Agricultural Machinery. 2024, 347: 26-28.
- [14] Chen F C, Qiao X L. Comprehensive Control of Non-Polluting Garlic Diseases and Pests [J]. China Fruit and Vegetable. 2008, 128: 30-31.
- [15] Li J M. Non-Polluting Garlic Mulch Covering Cultivation Techniques [J]. Qinghai Agricultural Technology Extension. 2008, 52: 13+66.
- [16] Yang Y J, Chen Q B. Main Diseases and Pests of Early Maturing Garlic in Winter and Spring and Their Comprehensive Control [J]. New Rural Technology. 2020, 473: 23-25.
- [17] Liang J, Cheng Z H. Research Progress on Garlic White Rot Disease and Its Control Methods [J]. China Vegetables. 2010, 217: 18-23.
- [18] Mu Z Q. Garlic Disease and Pest Control [J]. Jilin Agriculture. 2018, 424: 91-92.
- [19] Chen L B. Occurrence Patterns and Comprehensive Control Techniques of Garlic Diseases and Pests [J]. Hebei Agricultural Machinery. 2024, 350: 102-104.