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Research on the Occurrence Characteristics and Prevention Strategies of Cold Damage in Sweet Potatoes

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Abstract: This paper studies the occurrence characteristics and prevention strategies of cold damage in sweet potatoes. Through comprehensive analysis of relevant literature and experimental research on cold damage in sweet potatoes, the main characteristics and influencing factors of cold damage in sweet potatoes are revealed, including low temperature, humidity, and climate change. Based on these characteristics, a series of prevention strategies are proposed, including adjusting planting time, selecting cold-resistant varieties, and strengthening management measures, among others.

Keywords: Sweet potatoes; Cold damage; Prevention strategies

Introduction

Sweet potatoes are one of the important food crops in the world, but their cultivation is threatened by cold damage. With global climate change, the frequency and severity of cold damage in sweet potatoes are gradually increasing.The purpose of this paper is to reveal the main characteristics and influencing factors of cold damage in sweet potatoes through comprehensive analysis of relevant literature and experimental research, and to propose scientifically effective strategies for the prevention and control of cold damage, providing scientific basis and practical guidance for sweet potato growers.

1. Occurrence characteristics of cold damage in sweet potatoes

1.1 Impact of low temperature on sweet potato growth

Low temperature is a common environmental factor in the growth process of sweet potatoes and has an important influence on their growth, development, and yield formation. Low temperature can inhibit the physiological and biochemical metabolism of sweet potato plants, thereby affecting root development, chlorophyll synthesis, and photosynthetic efficiency. In addition, low temperature can also affect the absorption and utilization of nutrients by sweet potatoes, reducing the absorption capacity of roots for soil nutrients and thus reducing nutrient uptake and transport capacity of sweet potatoes. At the same time, low temperature can also affect the disease resistance of sweet potatoes, making them susceptible to disease attacks. Therefore, in the process of sweet potato cultivation, special attention should be paid to the impact of low temperature on plant growth, and corresponding measures should be taken, such as selecting appropriate planting time, using cold-resistant varieties, and strengthening insulation measures.

1.2 The role of humidity in cold damage to sweet potatoes

Humidity is a key environmental factor in the growth and occurrence of cold damage in sweet potatoes. Under high humidity conditions, water droplets are prone to accumulate on the surface of sweet potato leaves, leading to water retention and stomatal blockage, affecting plant respiration and photosynthetic efficiency. This humidity condition also increases the risk of sweet potato plants being attacked by pathogens and microorganisms, such as late blight. On the other hand, under low humidity conditions, sweet potato plants are prone to excessive water evaporation, leading to plant dehydration and leaf drying. Under such conditions, the resistance of sweet potato plants to low temperature will also decrease, thereby increasing the risk of cold damage. Therefore, in the process of sweet potato cultivation, attention should be paid to and humidity conditions should be appropriately adjusted.

1.3 The impact of climate change on cold damage in sweet potatoes

The impact of climate change on cold damage in sweet potatoes cannot be ignored. With global warming, climate change has directly affected the growth and development of sweet potatoes. Firstly, climate change has led to increased temperature and increased temperature instability, which poses more heat stress to sweet potatoes. High temperature can affect the physiological and metabolic processes of sweet potato plants, inhibit photosynthesis and respiration, and reduce yield and quality. In addition, climate change has brought irregular distribution

of precipitation, which may cause extreme weather events such as drought and waterlogging, which are troublesome for sweet potato growth. Lastly, climate change can also change the distribution and population size of pests and diseases, making sweet potatoes more susceptible to pest and pathogen attacks

2. Analysis of influencing factors of cold damage in sweet potatoes

2.1 Cold damage caused by temperature changes

Temperature fluctuations are one of the main factors leading to cold damage in sweet potatoes. Both excessively low and high temperatures can negatively affect the growth and development of sweet potatoes. In the case of extremely low temperatures, sweet potato plants suffer from cold stress, resulting in yellowing, wilting, and even death of leaves. Low temperatures also inhibit the physiological activities of sweet potatoes, slowing down photosynthesis and respiration, thus reducing yield and quality. On the other hand, excessively high temperatures also pose a risk of cold damage to sweet potatoes.

2.2 Cold damage triggered by humidity fluctuations

Humidity fluctuations are another important factor leading to cold damage in sweet potatoes. Excessive or insufficient humidity can have detrimental effects on sweet potato plants. Under high humidity conditions, sweet potatoes are prone to infection by pathogens and fungi, such as late blight. High humidity also results in water droplets accumulating on the surface of sweet potato leaves, obstructing gas exchange and effective utilization of light energy, thereby affecting photosynthesis and respiration efficiency, leading to reduced yield and quality. On the other hand, under low humidity conditions, plants face the risk of excessive water evaporation, increasing the chances of sweet potato dehydration and leaf drying. To mitigate cold damage caused by humidity fluctuations, appropriate irrigation management measures should be adopted to maintain suitable soil moisture levels, and proactive measures must be taken to prevent and control pests and diseases, thereby enhancing sweet potato's resilience and ensuring stable yield and quality.

2.3 The correlation between climate change and cold damage in sweet potatoes

There is a close correlation between climate change and cold damage in sweet potatoes. With global warming, changes in temperature, precipitation patterns, and the increase in extreme weather events have all affected the growth and development of sweet potatoes. Firstly, rising temperatures have reduced the risk of cold damage but increased the vulnerability of sweet potato plants to heat stress. Secondly, irregular distribution of precipitation can lead to drought or waterlogging, resulting in negative impacts on sweet potato growth. Therefore, it is crucial to address the impact of climate change on cold damage in sweet potatoes, by adopting measures such as selecting varieties with stronger adaptability, improving planting management methods, and enhancing resource utilization efficiency, so as to increase the resilience of sweet potatoes and stabilize yield and quality.

3. Prevention strategies for cold damage in sweet potatoes

3.1 Adjust planting time to adapt to climate conditions

Adjusting planting time is an effective strategy to cope with climate change. By selecting the appropriate planting time based on climate conditions, the risk of extreme temperatures, insufficient or excessive rainfall, and other adverse weather conditions can be minimized. For example, in regions experiencing warmer climates, planting time can be delayed to avoid the negative effects of high temperatures on sweet potatoes. Conversely, in areas with lower temperatures, planting can be done earlier to ensure sufficient growth time. By adjusting planting time, sweet potatoes can better adapt to climate change, reducing the impact of cold damage and other extreme weather events, thereby improving yield stability and the quality of agricultural products.

3.2 Planting cold-resistant varieties

When facing climate change and potential cold damage risks, it is wise to choose cold-resistant varieties for sweet potato cultivation. Cold-resistant varieties possess stronger tolerance to cold and exhibit better growth and development under low temperature conditions. These varieties are usually able to withstand lower temperatures and possess good recovery capacity from freezing injury. By selecting cold-resistant varieties for planting, the adverse effects of cold damage on sweet potato yield and quality can be reduced, enhancing harvest stability and economic benefits. To determine the most suitable cold-resistant varieties for local climate conditions, consultation with agricultural experts or research institutions is recommended to obtain information on traits such as quality, disease resistance, and adaptability, and make appropriate selections based on specific circumstances.

3.3 Strengthening management measures to enhance the cold resistance of sweet potatoes

To improve the cold resistance of sweet potatoes, a series of management measures can be implemented. Firstly, proper fertilization should be applied to maintain a good nutrient supply, especially phosphorus and potassium, which can enhance the cold resistance of the plants. Secondly, field management practices should be strengthened, such as timely weeding, maintaining suitable soil moisture, and ensuring

proper ventilation to promote plant growth and regulate temperature. Additionally, implementing appropriate covering and insulation measures in the field, such as using plastic film or straw mulching, can slow down the decrease in soil temperature and provide additional insulation. Lastly, it is important to select cold-resistant varieties that are adapted to the local climate conditions and adjust the planting time accordingly to avoid the low-temperature period and reduce the risk of cold damage. By adopting these comprehensive management measures, the cold resistance of sweet potatoes can be effectively improved, reducing the adverse effects of cold damage on plant growth and yield.

4. Conclusion

Taking appropriate measures is crucial in protecting sweet potato crops when facing climate change and the risk of cold damage. By adjusting planting time, selecting cold-resistant varieties, and implementing management measures, the cold resistance of sweet potatoes can be enhanced, reducing yield and quality losses. Moreover, actively addressing climate change and exploring more sustainable farming methods and technologies contribute to the sustainable development of agricultural production. Let us work together to contribute to the safe growth of crops and food security.

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