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Growth characteristics of glycine max trees in Vietnam

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Abstract
Vietnam has a diverse ecosystem, and the climate between regions is not the same. The terrain is up to 75% mountainous and often has a dry season in the north. Glycine max is a plant that is relatively sensitive to external conditions and belongs to the group of plants with poor drought tolerance. The work of selecting glycine max varieties with resistant genotypes is increasingly receiving research attention. This article explores the growth characteristics of glycine maxs to find ways to develop this crop to bring about higher economic efficiency in farming.

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1. Introduction

Drought-resistant properties of Glycine max plants

Drought is a concept used to refer to the lack of water in plants caused by the environment, which affects the growth and development of plants. Drought is the main cause of crop failure and reduced crop productivity. There is a type of drought caused by lack of water in the environment, but there is also a type of physiological drought that is not caused by a lack of water in the environment, but because the plant cannot absorb water in a low temperature environment, due to the concentration of the solution. environment is too high.

During drought, plants are stressed by water, which causes protoplasmic shrinkage and causes the plant to wilt. When there is a lack of water due to drought, the water supply to the roots is not enough at night to hydrate the tissues that have been deprived of water during the day, the root hairs are damaged in the outer layer of the bark covered with suberin... which reduces root pressure. to push the water column up into the xylem. Especially when there is a lack of water, many air bubbles will form in the xylem vessels, breaking the continuity of the water column, so the water column in the xylem vessels is not continuously pushed up [8].

Plants with thinner roots can grow deeper - a trait that can be exploited in soils affected by drought and nutrient deficiencies. New research shows that corn roots with fewer cortical cells in the outer layer of the root are more efficient at accessing water and nutrients. Corn roots have natural differences in the number of cortical cells in their roots. This difference may favor cropping on soils where deep roots are an advantage.

When lacking water, leaf growth and photosynthesis both decrease, but photosynthesis decreases less than leaf growth. This causes most of the photosynthetic products to be transferred to the roots, causing the roots to grow strongly. On the other hand, when there is a lack of water, the topsoil often dries out first and becomes hard, so the roots tend to grow in depth. Thus, developing the root system is a form of adaptation to drought.

When plants are drought-stressed, genes in the cells are active to synthesize products that participate in the cell's water retention process, which are osmotic substances, enzymes, molecular brokers...[11], [24]. The two main mechanisms that affect Glycine max drought tolerance are regulation osmotic pressure (ASTT) and root development [5, 6, 10].

2. Content

2.1. Ability to adjust osmotic pressure (ASTT)

One of the biochemical responses commonly seen in plants when they encounter water scarcity is the ability to regulate osmotic pressure in cells. Osmotic pressure is defined as the active accumulation of metabolites in plant tissues and cells to maintain cell and tissue tension when the amount of water outside the cells decreases. Osmotic pressure can maintain the intensity of stomatal transpiration and photosynthesis in cases of low water potential, slow down leaf chlorosis, reduce leaf wilting, stimulate root growth and increase Enhances the ability to absorb water from the soil.

An important characteristic of cells when dehydrated due to heat and drought is the ability to regulate osmotic pressure. The ability to adjust osmotic pressure to maintain water potential balance between cells and the environment is a form of adaptation to drought for many plants. When the soil is dry, the osmotic pressure of the soil solution is very high. If plants want to absorb water, they must adjust the osmotic pressure to increase it higher than the osmotic pressure of the environment to be able to absorb water. The regulation of osmotic pressure by the accumulation of solutes in the cell increases the osmotic pressure of the cytosol. To improve the drought tolerance of plants, we must first determine their drought tolerance, and take appropriate measures depending on the level of drought tolerance. Scientists also found that differences in the ability to maintain osmotic pressure do not significantly affect yield under local drought conditions or when grown under fully irrigated conditions. This result may be due to growth habits, drought levels and characteristics of the studied varieties. The ability to maintain osmotic pressure plays an important role. The ability to maintain osmotic pressure of the root system by influencing root tension will help penetrate deep into the soil layers and thus the ability to absorb Water reception will be improved for plants in drought conditions. There are many methods to determine the drought tolerance of plants, which can be based on indirect characteristics that affect the plant's ability to withstand drought, such as anatomical morphology and typical physiological characteristics of drought-resistant plants: such as transpiration intensity. water, water absorption capacity of cells, water shortage of plants, ability to withstand wilting of leaves... when faced with drought conditions, plants still grow and develop well, productivity is still normal, almost like when there is no drought. That tree has a high ability to adapt to drought and can be selected as a drought-resistant variety [3, 4, 10].

2.2. Relationship between drought tolerance and root development of Glycine max plants

To study the physiological, biochemical and cell structure drought tolerance characteristics, it was found that a series of changes at different levels during the developmental stages, related to the expression products of many genes. The physiological, biochemical and molecular biology basis of the drought-resistant characteristics of Glycine max plants is shown in (1) the ability of the root system to adapt to drought conditions, expressed in growth and the ability to sprout. root penetration, nitrogen fixation ability of Glycine max plants under drought conditions; (2) traits related to the adaptation of Glycine max leaves under drought conditions such as stomatal transpiration intensity, epidermal transpiration intensity, leaf hair density and utilization efficiency. water use; (3) the molecular nature of the relationship between root growth and penetration ability and drought tolerance of Glycine max plants [4, 5, 10].

2.3. Adaptability of the root system under drought conditions

The root system is one of the important parts of the plant that performs the task of collecting water to provide for the living activities and development of the plant body. In Glycine maxs, adaptation to drought conditions is mainly through the development of cylindrical roots that can search for water sources from deep soil layers. In addition, the fibrous root system also develops, helping the plant move towards soil layers with high moisture and search for nutrients such as phosphorus. One of the main factors affecting Glycine max root depth is the taproot elongation rate. Because cylindrical roots are first formed in Glycine maxs, identifying Glycine max varieties with rapid root elongation will allow determining the ability of roots to penetrate deeply. Differences in root elongation traits in Glycine max varieties have been studied in detail under greenhouse conditions. Subsequent studies on varieties with high root elongation ratios showed that these varieties can take water at a depth of over 120 cm compared to the remaining varieties. Some studies have also been conducted on the branch root system of Glycine max plants showing that under drought conditions the number of branch roots per unit root length increases significantly, but the length and diameter of the branch roots do not change. change. Water limitation in Glycine max plants often increases root biomass, thereby increasing the root/stem ratio. Research shows that irrigated Glycine max plants have shorter roots than non-watered Glycine max plants. In addition, scientists also found a very close correlation with many root traits such as weight. Dryness, length, structure and number of branch roots are often used to evaluate and identify drought-resistant Glycine max varieties. In Glycine max plants, when drought occurs in the early or late stages of the reproductive growth stage, it strongly increases root development, especially the root system in deep soil layers. The results from the studies presented above suggest that root-related traits can be used to improve Glycine max drought tolerance using conventional breeding methods.

Nitrogen fixation in legumes is often very sensitive to soil water status. Under drought conditions, Glycine max plants not only reduce their ability to fix CO_2 and reduce leaf growth, but their ability to fix nitrogen is also seriously affected. This results in reduced protein biosynthesis, which is an important component of Glycine max seeds and crop productivity. Many factors that limit the ability to fix nitrogen under drought conditions have been identified in Glycine max plants, including reduced ability to use O_2, reduced carbon source to the nodules, reduced sucrose synthase enzyme activity, reduced urea and free amino acids increased. Lack of water in the soil also leads to the accumulation of urea in Glycine max leaves and this consequence is the factor that inhibits the nodule formation process.

3. Conclude

Due to growth characteristics, glycine max plants can be grown on many different types of soil, but cannot grow normally on waterlogged soil. Depending on water supply conditions, glycine max roots can soon grow deep; In heavy soil, the roots are concentrated in the top layer of soil. The appropriate soil moisture for glycine maxs is in the range of 75 - 90% and soil moisture values less than 75% will inhibit the development and growth of plant organs. During flowering, the moisture requirements of Glycine max plants increase. Research results show that when soil moisture reaches a value equal to or less than 75%, the growth of organs in Glycine max plants begins to be inhibited. During the germination period, if there is enough moisture for the seeds to sprout evenly, if prolonged dryness will cause the seeds to rot and for germination, seeds require an appropriate humidity of 60 - 65%. Drought tolerance of Glycine max plants is related to two main mechanisms: root development and osmotic pressure adjustment. To avoid dehydration, drought-resistant plants have long, strong roots, roots that spread in large numbers, and have the ability to penetrate so deeply that they can absorb water from the soil in deep places. Young Glycine max plants are strongly affected by drought because the root system is still young and not fully developed.

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