

Research Progress in Physiological and Ecological Characteristics of Plant Drought Resistance

Chen Yaoming

Chaoyang Teachers College, Chaoyang, Liaoning, 122000, China

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Abstract: With the gradual deterioration of China's environment, water resources are gradually in short supply, which has a serious impact on people's living environment. As we all know, the survival of plants is inseparable from water resources. However, the increasing number of arid areas produces a huge impact on the growth of plants. China is a large agricultural country, where there are many areas with long-term drought. In order to effectively solve the problem of plant growth in these areas, it is essential to fully study the drought resistance of plants, and analyze and discuss the plant morphology and physiological indicators. Based on the analysis of the morphological structure and photosynthesis of plants, the physiological and ecological characteristics of plant drought resistance are studied by using the current experimental methods.

1. Introduction

At present, drought is an important problem that affects the development of agriculture in China. With the continuous development of social economy, it also has a greater impact on our living environment. As far as the current agricultural situation is concerned, the area of arid areas in China has exceeded more than half of the total land, especially in the northern grassland area. Due to the ecological damage in recent years, the ecological environment is extremely fragile, and the land desertification and drought disasters are becoming more and more serious. These problems exert a great impact on the agricultural development of our country. With the deepening of the concept of the western development in China, key strategic measures are actively carried out, among which, the research on the drought resistance ability of plants has been highly valued. The research on the environmental adaptability of plants, mainly including the analysis of the physiological and ecological characteristics of plants, explains the physiological mechanism of plants in adversity, so as to better develop the drought resistance pathway of plants and cultivate excellent drought resistance varieties, which is of great significance to the agricultural development in arid areas.

2. Significance of the Study on the Physiological and Ecological Characteristics of Plant Drought Resistance

China is a large agricultural production country, whose development of agriculture directly affects the improvement of the national economic level. Therefore, China attaches great importance to the research of agricultural technology level, so as to constantly research and develop innovative technology, and change the traditional pattern of agricultural production. In the process of plant growth, in addition to its own genetic control factors, it will also be affected by external environmental factors, such as water, soil and temperature. In the face of the external environment for plant growth, the most important one is water. In the arid environment, the lack of water resources is a common problem in the current agricultural production activities. China is a big country with water shortage. People's waste of water resources as well as the problem of soil erosion in the ecological environment lead to serious shortage of water resources in China, which has caused certain problems to the growth of plants. According to statistics, more than 50% of China's land is short of water. Especially in the northwest, there is a serious shortage of water. The long-term drought has led to major problems in agricultural production, such as slow growth and

development of plants, serious decline in crop production, and gradual deterioration of the ecological environment. As far as the impact of this situation on the growth of plants is concerned, the relevant departments should actively carry out the research on the physiological and ecological characteristics of crop drought resistance, give full play to the drought resistance of plants, and fully improve the salt tolerance of plants, which is of great significance to the development of modern plant research in China. For plants, their ability to resist drought is directly affected by their physiological characteristics and structural morphology, such as abscisic acid and tax control protein structure, as well as root and leaf.

3. Study on Physiological Index of Plant Drought Resistance

3.1 Effect of Proline on Plant Drought Resistance

The following is an analysis of the impact of proline content in plants on drought resistance. With eucalyptus urophylla as the research objective, five stages of soil moisture content have been tested and studied respectively. The research period is 30 days, and the five stages of water content are respectively 100%, 80%, 60% and 40% of pot planted soil moisture content. Under these five conditions, growth changes and physiological and ecological characteristics of eucalyptus urophylla seedlings were studied in different drought conditions. It can be seen from the experimental results that the degree of soil drought has a serious impact on a series of indicators, such as the growth height of eucalyptus urophylla seedlings, the density of leaves, the growth and area of leaves, biomass and so on. However, the growth length of roots and stems of eucalyptus urophylla seedlings is less affected by drought. The drought degree of soil has a great influence on the leaf water content, chlorophyll and free proline content of eucalyptus urophylla seedlings.

Proline is a kind of self-protection based on plant resistance to drought. Light drought forces plants to produce more proline. At the same time, proline protects protein, so that it will not be changed in water shortage. The interaction between the hydrophilic group of proline and the hydrophilic group of protein can effectively improve the stability of plant protein. Even in the case of severe drought, through the combination of proline and protein, it also greatly alleviates the impact of drought on plants. Generally, the proline content in plants is only $0.2\sim0.6\text{mg}\cdot\text{g}^{-1}$ dry weight, only accounting for one percent of the total proline content. When the plant is in a dry environment, proline will increase a lot, usually 10 times of the normal situation, more than one third of the total proline. The rapid accumulation of proline under the influence of drought not only effectively improves the osmotic mediation effect of plants and improves the dehydration resistance of plant tissues, but also protects the structure of protein, ensures the integrity of protein, and improves the flexibility of membrane. In the structure of plants, proline has a good ability of drought perception, mediating the acidity and alkalinity of plant cytoplasm, avoiding the occurrence of mildew, and effectively preventing the acidification of the cytoplasm.

3.2 Effect of Absciscic Acid on Plant Drought Resistance

Absciscic acid plays a vital role in plant growth and is one of the important elements in plant growth. In experiments, the plant growth environment is changed to make the plant grow in the environment with low temperature, high salt and alkali, or even severe pollution. Through research, it is concluded that the impact of bad environment on plants' abscisic acid will increase greatly. Through the role of abscisic acid, the plant can better fight against the bad environment. The increase of abscisic acid is consistent with the closing of stomata, which has a good effect on improving the drought resistance ability of plants. It can not only regulate the opening and closing of stomata, but also promote the water ion absorption capacity of plant roots. After a long-term theoretical study, when water shortage occurs in plants, a large amount of abscisic acid will be synthesized through leaves and transmitted to the roots through phloem structure, so as to promote the permeability of plant roots to water ions. Based on a variety experiments on tomato plants, when the content of abscisic acid is lower than that of normal tomato plants, its basic water absorption capacity will produce strong resistance, and this resistance will be reduced due to the external added

abscisic acid. Therefore, abscisic acid of plants can promote the dormancy effect of plant buds, reduce the growth speed of plants, promote the reduction of assimilated substances, reduce transpiration, improve water holding capacity of plants, prevent water loss, and increase drought resistance of plants.

3.3 Application of Aquaporin to Plant Drought Resistance

In the process of plant growth, the drought resistance ability of plant is directly related to the aquaporin of water channel of plant itself. Through aquaporin, the water transfer effect can be realized. Generally, aquaporin in plants are divided into vacuole water channel proteins and main water channel proteins.

For vesicular membrane aquaporins, they were first found in arabidopsis. At present, many plants are rich in aquaporins, which mediate the water potential and the distribution of salt ions in cells. Plants can adjust and control the aquaporin by themselves, so as to enhance the material exchange effect of plant cells and environment, realize the permeability of membrane water, change the permeability of plants, and improve the drought resistance ability of plants.

4. Study on the Ecological Index of Plant Drought Resistance

4.1 Effects of Ecological Characteristics of Plant Leaves on Drought Resistance

In the study on the smilax and ecological index of soybean, based on a large number of experimental data, it is found that many ecological characteristics of soybean plants will be affected in the arid environment. At the same time, when suffering from drought, it can also maintain a good water state and keep a good drought resistance ability. In the research, the important index that reflects the water status of plants is leaves. Through the analysis of water potential, water content and water holding capacity of leaves, we get to know the drought resistance capacity of plants. Compared with water potential, the water content of leaves can more directly reflect the water situation of plants, because it directly reflects the water supply and transpiration effect of plants. When there is drought in soybean plants, the growth and development of soybean will be affected to different degrees. The height, branch number and grain weight of soybean plants will have different degrees of drought resistance.

As an important part of plant transpiration, when leaves are in drought environment for a long time, the morphological structure will change, which directly affects the drought resistance ability of the plant. The specific performance is that the outer epidermis of leaves usually contains rich cuticle, through which the function of plasma membrane is fully played. It can effectively prevent the loss of water in the leaves and avoid the important components of plant water evaporation. The thickness of cuticle determines the ability of plant to reflect and transpiration, thus affecting the drought resistance. Meanwhile, the leaves of plants with good epidermal hairs also plays a role in light avoidance and water loss reduction caused by transpiration. Leaves also have good grid structure, which is usually distributed on both sides of the back and abdomen. When the plants appear wilting due to water shortage, it can effectively reduce the mechanical damage of the plants, and effectively reduce the damage caused by water loss to the plants.

4.2 Application of Plant Roots to Drought Resistance

As an important part of plants, root plays a key role in the absorption of water. The growth of plants mainly depends on the absorption of water and other nutrients. The developed root system fully absorbs water in the soil, so that the plants can survive the drought period safely in the environment with sufficient water for a long time. In the experiment, the root research of sorghum plant is cut open. We have found the water absorption of sorghum root is good and the root depth determines the water absorption under the condition of quantitative water content in the soil. The poor water absorption of root is mainly caused by the insufficient root length. The root water potential can also effectively reflect the water absorption capacity of plant roots. If the root water potential is relatively low, the water absorption capacity is relatively strong. Generally, the drought

resistance capacity of plants is strong, and the root water potential is relatively low, which is conducive to the absorption of water in the soil by plants.

5. Conclusion

To sum up, at present, China's arid areas are gradually expanding. Drought disaster is one of the most serious natural disasters in China. The frequent occurrence of drought in China has seriously affected the growth of plants, agricultural production activities and food shortage. Therefore, in order to better promote the development of agriculture, it is of great significance to actively carry out the research on plant drought resistance. According to the physiological and ecological characteristics of plants, the advantages and disadvantages of plant drought resistance are to be found, so as to comprehensively develop the drought resistance ability of plants, and promote the continuous improvement of agricultural level.

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