Research Article

Effect of Drought Stress on Growth and Development in Winter Wheat with Aquasorb-Fertilizer

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Abstract: Jimai 22 as the experiment material, by pot experiment, set the control (CK), mild drought stress of 5% Polyethylene Glycol (PEG)-6000 (T1), moderate drought stress of 10% PEG (T2) and severe drought stress, 20% PEG (T3), study the effect of Drought stress on growth and development in Winter Wheat with Aquasorb-fertilizer, measuring the individual forms of wheat and physiological and biochemical indicators. The results showed that, in the case of the Aquasorb-fertilizer, there were less impact on the wheat, especially in mild lower, compared with the control, the results indexes difference were not significant, Aquasorb-fertilizer can mitigate drought on the wheat the impact.

Keywords: Aquasorb-fertilizer, drought, malondialdehyde, proline, winter wheat

INTRODUCTION

Wheat is one of the important food crops in the world, which about 70% of the area is located in the arid and semi-arid areas (Zhang and Zheng, 2011). Drought stress can decrease the wheat production. Alleviation the impact of drought on wheat was way to increasing the wheat production. Chemical water technology is the rapid development of new forestry technologies in recent years, such as complex multifunctional Aquasorb-fertilizer and liquid membrane. Aquasorb-fertilizer is the composite materials made of aquasorb, fertilizer and special filler. The water retaining agent can absorb and maintain its own weight several hundred times and even thousand fold deionized water of the polymer compound, and the absorption of moisture more than 85% of the plant roots can be used from the group consisting of water. Aquasorb also improve soil structure, increase soil aggregates, and increase the permeability of the soil. Aquasorb-fertilizer can increase the utilization of nitrogen, phosphorus, potash fertilizer, increase tree drought, cold hardiness, resistance to pests and diseases. Therefore, increase in the moisture content in the soil, improving the physical and chemical properties of the soil, to enhance its water retention, nutrient preserving capability, has become an important link in the drought-resistant water-saving and sustainable agricultural development. The use of Aquasorb-fertilizer can alleviate the impact of drought stress on wheat. Especially in the arid and semi-arid areas, mixed the moisture and nutrient, and regulation in one practice and materialized beneficial fertilizer coupling theory and chemical regulation, with the actual production of meaning, has an important role to promote efficient water-saving agriculture. A certain concentration of PEG can make the plant tissue and cells in a similar drought stress period. Aquasorb-fertilizer conditions, for wheat seedling morphology and biochemical characteristics change the impact of PEG stress, which few people do, in order to provide a theoretical basis for improvement of biomass of wheat of the growth of the late, we explore its expression and function of drought stress molecular mechanism to further improve the early stage of wheat growth, we study the experiment form of physiological and biochemical characteristics of wheat seedling stage drought stress because of the Aquasorb-fertilizer existing and provide a theoretical basis for the effect of drought stress on wheat.

MATERIALS AND METHODS

Experimental design: Experimental material: Jimai 22, Aquasorb-fertilizer, provided by the Qingdao Xinyao high-tech Material Co., Ltd., Pot experiment, the basin length of 30 cm, width 20 cm, height 15 cm, Weight the 1 g (provided by the Qingdao Xinyao high-tech
Material Co., Ltd.) Aquasorb-fertilizer and 2.5 kg fine soil mix installed in the pot, transplant nine growing wheat seedlings in pots, placed in an incubator to culture, and pouring 100 mL of water to grow to three leaves. This experiment set up four treatments (referred to as CK, T1, T2, T3) respectively poured concentrations were 0.5, 10, 20% PEG solution daily pouring 100 mL, until wheat grow to four leaves, when the first sampling, and subsequently every four days to Sampling and three strains of Wheat every time.

Items:

Individual morphological index:

Plant height, Root length: ruler measurement

Fresh weight: electronic balance directly weighing

Dry weight: Placed in the oven at 100°C, until the quality is no longer changed, and then weighing

The physiological indicators measured: Malondialdehyde (MDA): Thiobarbituric acid method (Zuo and Wu, 2010) Proline (Pro): The acidic ninhydrin method (Fan et al., 2011).

RESULTS

The effect of drought stress on Wheat individual form: Wheat plant height is a reliable form of growth indicators to reflect plant drought resistance. We can be seen from Table 1, between the treatments, T3 and CK, T1, T2 are the differences significant, but T2 and T3 the difference was not significant, this shows that the Aquasorb-fertilizer had slowed the effect of drought stress. For root length, fresh weight, dry weight, and between different treatments, T2 and T3, T3, and T4 difference is not significant. Between the treatments, in the first sample with the second sample, the individual morphological characteristics whether the difference is significant between the two previous sampling, but the results of determination of the third sub-sampled and pre difference was significant, Aquasorb-fertilizer for moderate drought stress has a significant role.

![Fig. 1: Effect of drought stress on growth and development in MDA content of winter wheat seedlings with aquasorb-fertilizer](image1.png)

![Fig. 2: Effect of drought stress on growth and development in pro content of winter wheat seedlings with aquasorb-fertilizer](image2.png)

Effect of Drought stress on growth and development in MDA content of Winter Wheat seedlings with Aquasorb-fertilizer: In Fig. 1, in a certain time range, between the same treatments, the MDA content was increased with PEG concentration increasing, wheat plants began to wilt when the third sample, in the same under drought stress. MDA increasing the difference was not significant, indicating drought stress had less impact on the wheat with the Aquasorb-fertilizer.
Effect of drought stress on growth and development in procontent of winter wheat seedlings with A quasorb-fertilizer: In Fig. 2, between the same treatments, the increased of proline was more gentle, the proline content was less compared with what has been done than before the experiment, indicating drought stress had less impact on the wheat with the Aquasorb-fertilizer.

DISCUSSION

Drought stress inhibited the growth of wheat seedlings, under drought stress, the occurrence of the primary root and secondary roots were inhibited (Zhang et al., 2011); reduction of water to promote root growth, and the root was relatively stout (Ma et al., 2012). For drought stress, the continuous growth of the root induced by the deep water, at the same time, due to the lack of water, the aerial parts of slow growth, aboveground growth was inhibited, studies have shown that (Yuehua, 2013; Li and Ma, 2013), drought stress suppressed the dry matter accumulation in wheat seedling, so for plant height, root length, fresh weight, dry weight, etc. the trend were decreasing, but no significant difference between each treatment, the effect of the experiment was better with the Aquasorb-fertilizer.

The plant free proline massive accumulated when the plants subject to drought stress, the reason is: proline dehydrogenase activity is decreased and made the proline oxidation weakened; drought suppressed the protein synthesis, proline utilization is decreased and made primary root and secondary roots were inhibited (Zhang, Y.Q., Q. Lin, J.B. Liu, H.S. Zhang and C.X. Zhao, 2011); the innovation team in wheat of Shandong province “cultivation and soil fertilizer (621135)” and The Taishan Mountain Scholar Constructive Engineering Foundation of Shandong Province.

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