Advance Journal of Food Science and Technology 5(11): 1502-1504, 2013
ISSN: 2042-4868; e-ISSN: 2042-4876

Submitted: July 22, 2013 Accepted: August 03, 2013 Published: November 05, 2013

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 (T2water treatment levels) and severe drought stress, 20% PEG (T3), study the effect of 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 drought stress (Sang *et al*., 2011), can effectively simulate the soil arid environment, previous use of PEG osmotic stress research literature wheat seedling stage also has been reported, such as JI Sheng Dong (Liu *et al*., 2008) found that the three-leaf stage is an important physiological turning point of the wheat PEG seedling 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

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Table 1: Effect of drought stress on growth and development in individual forms of winter wheat seedlings with aqua orb-fertilizer

	January 20				January 25			
Treatment	Plant high (cm)	Root length (cm)	Fresh weight/g	Dry weight/g	Plant high (cm)	Root length (cm)	Fresh weight/g	Dry weight/g
CK	34Aa	31.666Aa	0.8651Aa	0.0737Aa	37.0Aa	34.900Aa	0.9508Aa	0.2443Aa
T1	30Bb	21.000Bb	0.6591Bb	0.0661Aa	29.0Bb	33.826Bb	0.6091Bb	0.1903Ab
T2	29Bb	16.566Bb	0.6432Bb	0.0651Aa	28.8Bb	22.9433Cc	0.5517Bb	0.1169Bb
T3	26Cc	15.670Cc	0.5036Bc	0.0598Aa	27.00Bc	21.5667Cc	0.5225Bb	0.0975Bc

	January 30			
Treatment	Plant high (cm)	Root length (cm)	Fresh weight/g	Dry weight/g
CK	33.6Aa	34.9826Aa	2.7494Aa	0.41730Aa
T1	31ABb	27.9667Bb	1.6846Bb	0.3048ABb
T2	31ABb	25.233BCc	0.6908Cc	0.2909aBb
T3	29Bc	23.36670bc	0.6707Cc	0.25340Bb

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.

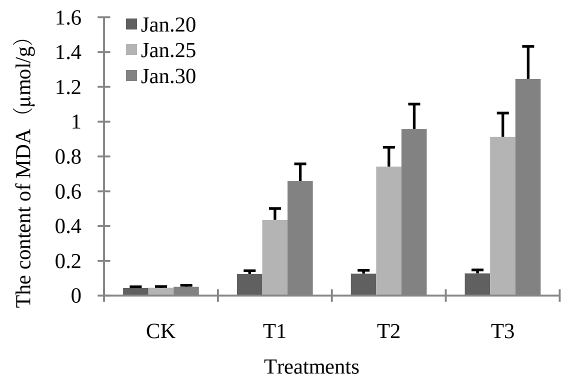

Fig. 1: Effect of drought stress on growth and development in MDA content of winter wheat seedlings with aquasorb-fertilizer

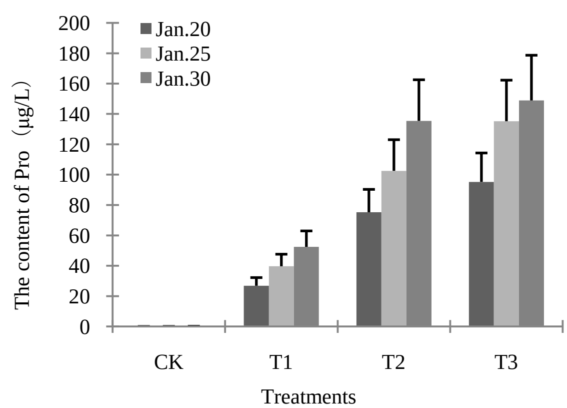

Fig. 2: Effect of drought stress on growth and development in pro content of winter wheat seedlings with aquasorb-fertilizer

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 praline 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 to increased accumulation in plants (Zhan *et al*., 2011), Therefore, the proline content is positively correlated with drought resistance in wheat seedling, they thinked (Gabor *et al*., 2004) that the accumulation of proline contents could as physiological indicators of stress resistance. In this experiment, indicating drought stress had less impact on the wheat with the Aquasorb-fertilizer.

MDA is one of the peroxidation because of the membrane lipid caused of aging plant organs or Adversity; we usually made it as lipid peroxidation, and represent membrane lipid peroxidation and the strength of the response under stress conditions (Schottler and Kirchhoff, 2004). In this experiment, in a certain time range, between the treatments the increase of MDA differences were not significant, indicating drought stress less impact on the wheat with the Aquasorb-fertilizer.

ACKNOWLEDGMENT

Supported by the program of “The research on the efficient use technology and demonstration of nitrogen fertilizer in main crops (201203079)”; “Integrated research and demonstration of the balanced increase in winter wheat and summer maize in Shandong Province (2012BAD04B05)”; the innovation team in wheat of Shandong province “cultivation and soil fertilizer (6211 35)” and The Taishan Mountain Scholar Constructive Engineering Foundation of Shandong Province.

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