Effects of Cd Stress on the Physiological Characters of Aijiaozhenuo (2) and Bayuebai

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Abstract: In order to explore the toxicity of Cd to rice seedling growth, including the longest root , root length, the influence of different plant physiological traits of two rice cultivars —— Aijiaozhenuo (2) Bayuebai were studied with roots exposed to different Cd concentration in hydroponic culture. The results show :(1) Cd stress significantly inhibited the growth of Aijiaozhenuo (2) and Bayuebai rice root . When Cd was less than or equal to 0.5mg/L, it had little effect on the growth on rice root of Aijiaozhenuo (2), but significantly inhibited the growth of rice root of Bayuebai .When the Cd is greater than 0.5mg/L, the resistance of Aijiaozhenuo (2) to Cd is better than Bayuebai.(2) the rice seedlings of Bayuebai grow slowly under Cd stress, and the rice seedlings in Bayuebai grow weaker than Aijiaozhenuo (2).

1. Introduction

In the natural environment, Cd often exists in combined states, usually in very low levels.it will not harm human health in the general environmental state. In recent years, due to natural causes and man-made influences. for example, with the development of industrial and agricultural production, the discharge of industrial "three wastes" has increased, the treatment of solid waste has been poor, the pollution of agriculture itself is serious, and the content of toxic heavy metals in farmland soil has increased sharply.[1-3]When the environment is polluted by Cd, it accumulates through the food chain and eventually enters the human body, causing chronic poisoning.

Cd is not a necessary element for biological growth. It is not involved in the metabolism of living things.Data show that the critical value of plant toxicity was higher than that of human toxicity. In other words, soil containing Cd, although does not affect the development and growth of plants, Might harm human health.[4]This experiment select Aijiaozhenuo (2), Bayuebai as the research material, hydroponic method, research the influence of Cd to in growth morphology and physiological and biochemical process, varieties of Cd to prove that differences in response and toxic mechanism under Cd stress, to select and cultivate rice varieties of resistance to Cd and the Cd tolerance mechanism to provide theoretical support.

2. Materials and Methods

2.1. Materials

The materials used in this experiment were Aijiaozhenuo (2) and Bayuebai. The seeds from Guizhou Rice Resource Institute.

2.2. Methods

Design 4 treatments, Based on the improved hoagrand nutrient solution, the hydroponics method was used to transfer different concentrations of cadmium sulfate with concentrations of 0.5, 2, 8, and 16mg/L, respectively, and the improved hoagrand nutrient solution was used as the control.

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2.3. The Data Analysis

SPSS19.0 software was used for data processing.

3. Results and Analysis

3.1. Effects Of Cd On Root Length Of Aijiaozhenuo (2) and Bayuebai Rice Seedlings

Table 1 Effects of different Cd concentrations on the root length of Aijiaozhenuo (2) and Bayuebai root

Concentration					
Varieties	Ck	0.5 mg/L	2 mg/L	8 mg/L	16 mg/L
Aijiaozhenuo (2)	3.22 a	3.10 a	2.65 ab	2.42 b	2.37 b
Bayuebai	3.39 a	2.45 b	2.32 b	2.17 b	2.15 b

As can be seen from table 1,Cd solution with different concentration had different effect on root growth of rice seedlings. For Aijiaozhenuo (2), When the concentration of Cd is less than 2mg/L, the difference is not significant; The difference was significant when the concentration of Cd was greater than 8mg/L. For Bayuebai, the concentration of Cd is greater than or equal to 0.5mg/L, Significant difference.

3.2. Effects of Cd on The Root Number of Rice Seedlings of Aijiaozhenuo (2) and Bayuebai

Table 2 Effects of different Cd concentrations on the number of root in rice seedlings of Aijiaozhenuo (2) and Bayuebai

Concentration					
Varieties	CK	0.5 mg/L	2 mg/L	8 mg/L	16 mg/L
Aijiaozhenuo (2)	11.33 a	12.33 a	10.67 ab	10.44 b	10.22 b
Bayuebai	7.33 a	8.44 a	6.78 b	6.33 b	5.78 b

As can be seen from table 2, Cd solutions with different concentrations had different effects on the occurrence of new roots in rice seedlings of the two varieties. Both varieties showed increased Cd concentration and less and less prolonged treatment time. The effect on the growth of new roots on Aijiaozhenuo (2) is significantly different when the concentration of Cd was 8mg/L The effect on roots of Bayuebai is significantly different at the concentration of 2mg/L Cd, and promoted the occurrence of new roots at the concentration of Cd of 0.5mg/L, while new roots did not occur in rice seedlings when the concentration of Cd was greater than 0.5mg/L.

3.3. Effects of Cd on Rice Seedling Height of Aijiaozhenuo (2) and Bayuebai

Table 3 Effects of different Cd concentrations at the plant height on rice seedlings of Aijiaozhenuo (2) and Bayuebai

concentration					
varieties	ck	0.5 mg/L	2 mg/L	8 mg/L	16 mg/L
Aijiaozhenuo (2)	7.35 a	6.41 b	6.38 b	6.25 b	6.25 b
Bayuebai	9.26 a	7.80 ab	7.71 ab	5.86 b	5.04 b

As can be seen from table 3. Different concentrations of Cd had different effects on the occurrence of new roots in rice seedlings. With the increase of Cd concentration, the growth rate of plant height showed a downward trend. For Aijiaozhenuo (2), there was a significant difference at the lowest Cd concentration, with a maximum decrease of 0.13 between concentrations. For Bayuebai , the difference was significant when the concentration of Cd was greater than or equal to 8mg/L, with a maximum reduction of 1.85 between concentrations. Compared with the control group, the decrease of Bayuebai was 4.22, while that of Aijiaozhenuo (2) was 1.1.

3.4. Effects of Cd on Leaf Growth on Rice Seedling of Aijiaozhenuo (2) and Bayuebai

With the increase of treatment concentration and the extension of time, from the beginning one

leaf began to turn yellow and roll, to the end of the whole plant died. With the increase of Cd concentration, this phenomenon appeared earlier and became more obvious. Aijiaozhenuo (2) seedling leaves died on day 18 at 8mg/L Cd concentration; Die on day 14 at 16mg/L Cd concentration. Bayuebai seedling leaves died on day 16 at 8mg/L Cd concentration. At a concentration of 16mg/L, Cd died on day 12.

4. Discuss

4.1. Effects of Cd Stress on the Root Systems of Aijiaozhenuo (2) and Bayuebai

The results showed that Cd could poison the root growth on rice seedlings of Aijiaozhenuo (2) and Bayuebai .When Cd≥2mg/L, the growth of Aijiaozhenuo (2) roots was inhibited, and the inhibitory effect was enhanced with the increase of Cd concentration and treatment time. The concentration of Cd was 0.5-2mg/LCd, which had little effect on root growth and new roots. For the growth of Bayuebai roots, Cd at different concentrations could inhibit the growth. The higher the concentration of Cd, the stronger the inhibitory effect. To some extent, this also reflects the toxicity of higher concentrations of Cd to rice roots, and the results of this study are consistent with the results of studies on sunflower, wheat and rape [5-7].

Comparing the two materials, the roots of Aijiaozhenuo (2) seedlings could grow normally in the environment with Cd concentration less than 2mg/L, and the roots of Bayuebai seedlings were significantly inhibited when Cd concentration was greater than or equal to 0.5mg/L. This indicated that Cd inhibited the growth of seedling root in Bayuebai more than that of Aijiaozhenuo (2), and Aijiaozhenuo (2) is more tolerant than Bayuebai. Low Cd concentration (0.5mg/L) can stimulate new root formation in Bayuebai seedlings. The concentration of Cd was greater than or equal to 2mg/L, with no new roots, and the difference was significant. The results showed that the tolerance of Aijiaozhenuo (2) is stronger than that of Bayuebai.

4.2. Effects of Cd Stress on the Ground Upper Part of Aijiaozhenuo (2) and Bayuebai

As can be seen from table 3, with the increase of Cd concentration, the plant height of Aijiaozhenuo (2) and Bayuebai grow more and more slowly. Cd inhibited the growth of Aijiaozhenuo (2) and Bayuebai plant height, while low concentration of Cd inhibited the growth of Bayuebai plant height, but high concentration of Cd inhibited the growth of Bayuebai plant height .In studies on wheat, barley, peas and maize [8-15], Cd inhibited the growth and development of plant height.

Comparing the two materials, under the condition of low concentration of Cd, the inhibition degree of plant height of Bayuebai was lower than that of Aijiaozhenuo (2), indicating that Bayuebai was more tolerant than Aijiaozhenuo (2) under the condition of low concentration of Cd.With the increase of Cd concentration, Bayuebai plant height inhibition degree higher than Aijiaozhenuo (2) the comparison between different concentrations of two varieties of data changes, Bayuebai biggest drop is far higher than 1.85 short feet 0.13 Aijiaozhenuo (2), compare at the highest concentration and the contrast of two varieties of data changes, its 4.22 of Bayuebai higher than 1.1 of Aijiaozhenuo (2) , show that Aijiaozhenuo (2) has good tolerance to Cd stress.

Comparing the two materials, under the conditions of Cd concentration of 8mg/L and 16mg/L, both rice seedlings in Bayuebai and Aijiaozhenuo (2) eventually died, Aijiaozhenuo (2) survived 2 days longer than Bayuebai rice, indicating that Aijiaozhenuo (2) have better tolerance to Cd stress.

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6. Conclusion

The results showed that :(1) Cd stress significantly inhibited the growth of Aijiaozhenuo (2)and Bayuebai rice root . When Cd was less than or equal to 0.5mg/L, it had little effect on the growth on rice root of Aijiaozhenuo (2), but significantly inhibited the growth of rice root of Bayuebai .When the Cd is greater than 0.5mg/L, the resistance of Aijiaozhenuo (2) to Cd is better than Bayuebai. (2) The rice seedlings of Bayuebai grow slowly under Cd stress, and the rice seedlings in Bayuebai grow weaker than Aijiaozhenuo (2).To sum up, in terms of root growth, plant growth and leaf growth, Aijiaozhenuo (2) is more resistant to Cd than Bayuebai.

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