Effect of plasma treatment in growth and chemical contents of Korean naked barley

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Abstract:
During the growth of Korean naked barely, plasma treatment was performed once a day for 3 days after sowing. Korean naked barely was grown for 9 days. The weight increased by 37% after the first treatment, and by 15% after the second treatment. The length was increased by at the minimum of 0.4% and maximum of 17% depending on the number of plasma treatment. Gamma aminobutyric acid (GABA) content increase with the number of plasma treatment. Also, Saponarin and polycosanol content of barley treated with plasma was higher than that of untreated. Plasma can enhance the barely growth and increase the chemical content.

Keywords: Plasma, Naked barley, GABA, Saponarin

1. Introduction

Plasma, which is often regarded as the 'forth state of matter', is a partially ionized gas, which contains a mixture of electrons, photons, atoms, radicals and various excited and non-exited molecules. The recent tendency in plasma applications has been shifted from manufacturing industry to bio-conversion industry such as plasma medicine, plasma biotechnology, plasma agriculture and food since the early of 21 century. It has attracted great attention of many scientists all over the world. Among interesting plasma agriculture studies, the regulation of seed germination and plant growth is a very fascinating part. The use of low-plasma in agriculture and food applications has been newly launched and has been recently investigated in the field of agricultural science as an alternative to the traditional pre-sowing seed treatment such as physical scratching, heat treatment and chemical treatment. Many scientists have made every effort to examine the biological effects of plasma on seed germination and plant growth. However, the biological effects of plasma action on agriculture have not been well studied. We have studied step by step from biological responses to clarification of detailed mechanisms with appropriate plasma and target samples. The influence of low-plasma treatment during the barley (*Hordeum vulgare* L.) growth has been investigated. The weight, length and chemical contents of barley sprout were investigated.

2. Materials and method

The plasma treatment of barely has carried out for 6 min using atmospheric pressure Surface Dielectric Barrier Discharge (SDBD) under fixed nominal power 19.5 W. During the growth of Korean naked barely, plasma treatment was performed once a day for 3 days after sowing. Korean naked barely was grown for 9 days, at 15℃. The cultivar was Saechal, Korean naked barley. GABA content was analyzed with UPLC after derivatization (Waters derivatization kit). Saponarin and polycosanol content was analyzed by UPLC with CAD detector.

3. Results and Discussion

The weight was in the range of 41.5~64.4 g according to the number of plasma treatment (Fig. 2). After the first treatment, the weight increased by 37% and by 15% after the second. The length was 4.1~4.8 cm, and it was increased by the minimum of 0.4% and maximum of 17% depending on the number of plasma treatment. GABA content of barley treated with plasma was higher than that of untreated. GABA content was in the range of 1085.58~1543.05 ppm (Fig. 3). Saponarin and plycosanol content showed a similar tendency (Fig.4). The content increased after the first treatment and decreased slightly with increasing frequency of treatment. Saponarin content was 47.5~91.5 mg/100g, and polycosanol content was 35.3~78.6 mg/100g. Most of amino acid contents were increased with plasma treatment. The comparison of plant growth, weight and chemical components between plasma treated and non-treated samples obviously shows that plasma can enhance barley growth and increase the chemical contents.

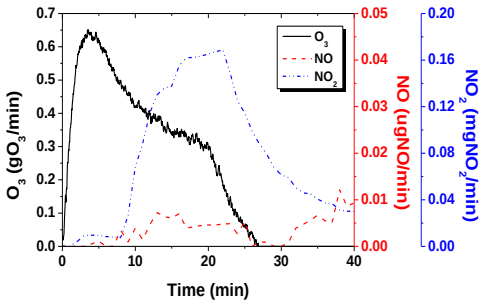

Fig. 1. Change of reactive species by atmospheric pressure dielectric barrier discharge plasma treatment.

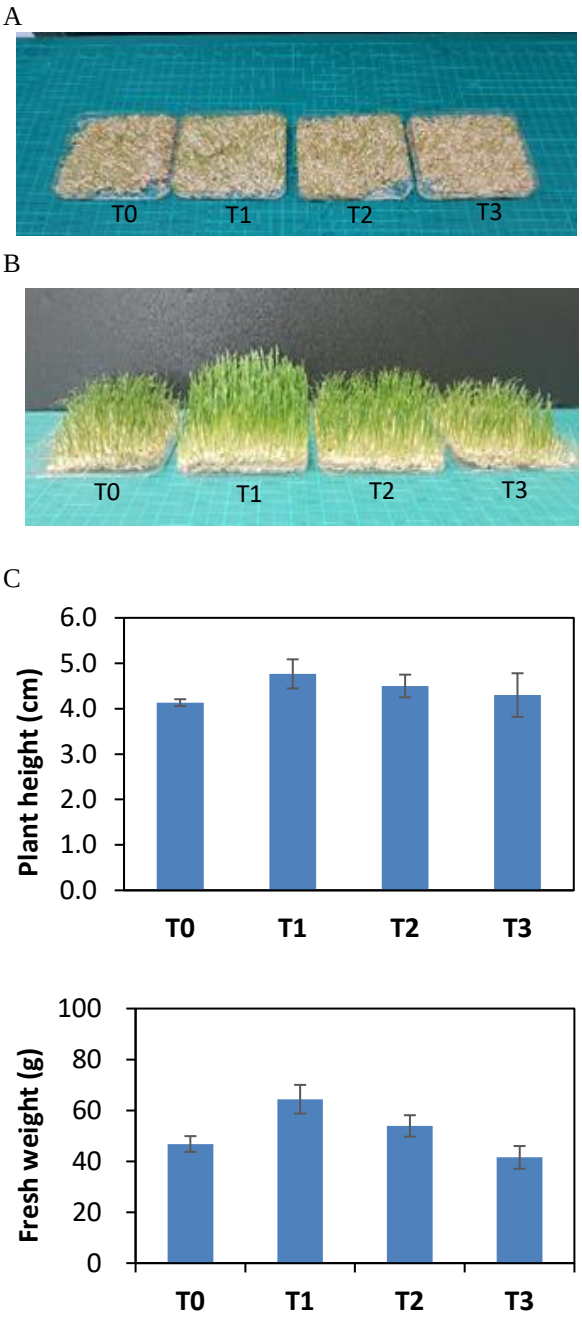

Fig. 2. Seedling growth analysed in 8 days. A, Image of 5days grown from seeds. B, Image of 8days grown from seeds. C, Whole length and fresh weight of barley sprout 8 days grown after sowing. To; control, T1; once plasma treated for 6 min on first day after sowing, T2; twice plasma treated for 6 min each on first and second day after sowing, T3; three times treated each on first, second and third day after sowing.

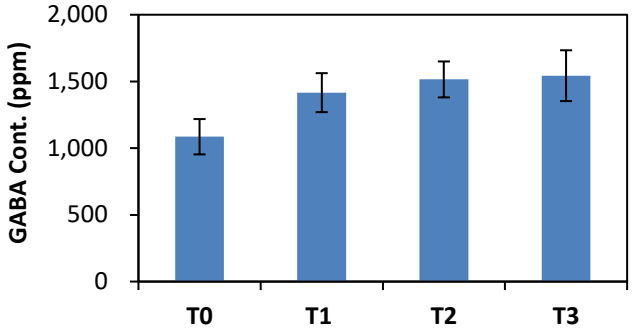

Fig. 3. GABA content of barley seedling grown 9days after sowing. To; control, T1; once plasma treated for 6 min on first day after sowing, T2; twice plasma treated for 6 min each on first and second day after sowing, T3; three times treated each on first, second and third day after sowing.

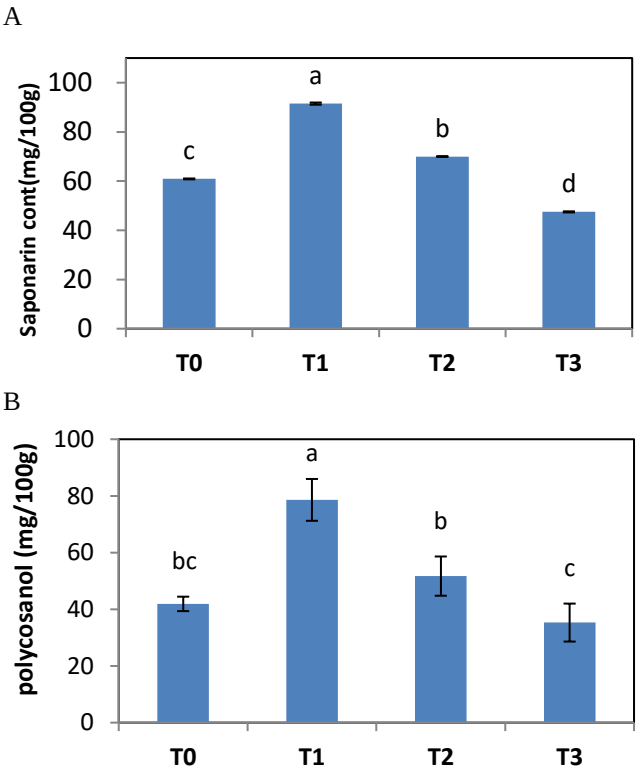

Fig. 4. Saponarin(A) and polycosanol(B) content of barley seedling grown 9days after sowing. To; control, T1; once plasma treated for 6 min on first day after sowing, T2; twice plasma treated for 6 min each on first and second day after sowing, T3; three times treated for 6 min each on first, second and third day after sowing.

4. References

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