

Effects of atmospheric pressure plasma to various plant families on plant growth enhancement

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Recently, we have found non-thermal air plasma irradiation to seeds of *Arabidopsis Thaliana* shows 11 % reduction of harvest period and 56 % improvement of crop yield [1]. Such plasmas produce a huge amount of reactive species with less heat damage to living body, which opens wide variety applications to medicine and agriculture [2]. Here we have irradiated to 12 species of plants to examine difference of plasma growth enhancement effects among species of plants.

Experiments were carried out with a scalable dielectric barrier discharge device [1-2]. The discharge voltage and current were supplies 9.2 kV and 0.2 A. 10 seeds for each species were arranged 3 mm below electrode with 3 min plasma irradiation. After the irradiation, the seeds were cultivated under soil tab for *Arabidopsis*, Sunflower and *Plumeria* whereas rest of others is under water tray. The length of their stem was measured at 3 days for beans and 14 days for flowering species after the cultivation. The ratio of length with plasma irradiation to that without irradiation was employed as growth enhancement index as shown in Table 1. 12 species of plants were classified into 6 families. We found that plant growth enhancement of plasma depends on species and not on family.

Strong growth enhancement above 140% in the index shows for Radish, *Plumeria*, Wheat, Rice, Zinnia, and *Arabidopsis*, Mung bean, Potato, Broccoli, and Sunflower got a little growth enhancement between 100% and 140% in the index. In contrast, Soybean and Winged bean are inactivated by plasma irradiation. Comparative study on the other characteristics of seeds such as physical properties of husk and structure of seeds will be discussed in this conference.

Reference

[1] K. Koga, et al., Appl. Phys. Express **9**, 016201 (2016).

[2] T. Sarinont, et al., Arch. Biochem. Biophys., 605, 129 (2016).

Plant name	Family	Species	Growth enhancement index
Radish	<i>Brassicaceae</i>	<i>R. raphanistrum</i>	242%
Arabidopsis		<i>A.thaliana</i>	142%
Broccoli		<i>B. oleracea</i>	107%
Mung bean	<i>Fabaceae</i>	<i>V. radiata</i>	138%
Soybean		<i>G. max</i>	96%
Winged bean		<i>P. tetragonolobus</i>	92%
Sunflower	<i>Asteraceae</i>	<i>H.annuus</i>	104%
Zinnia		<i>Z. elegans</i>	145%
<i>Plumeria</i>	<i>Apocynaceae</i>	<i>P. rubra</i>	192%
Potato	<i>Solanaceae</i>	<i>S. tuberosum</i>	114%
Rice	<i>Poaceae</i>	<i>O. sativa</i>	147%
Wheat		<i>T. aestivum</i>	165%

Table 1. Effects of plasma irradiation to seeds on plant growth.