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コンビナトリアルプラズマ照射による植物の成長促進
Growth enhancement of plants using combinatorial plasma irradiation

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According to Malthus, the population growth has an exponential nature, whereas the food supply growth has a linear one.[1)] This population overshooting resources may lead to the Malthusian catastrophe, which has come true as the recent global food crisis. One possible solution to the global food crisis is significant improvement of agricultural productivity by some means. Plasma can be a novel way to boost agricultural productivity. Here we show that 50 s plasma irradiation to seeds induces continuous growth enhancement of the plants more than three weeks after their germination.

"Plasma irradiation" means simultaneous irradiation of electrons, ions, radicals, and photons, so that it is difficult to identify key species among them. We applied combinatorial plasma irradiation for which irradiation fluxes of these species depend on the distance from the discharge plasmas. Figure 1 shows normalized length of Oryza sativa, Raphanus sativus L. and Zinnia after 3 weeks cultivation with 50 s plasma irradiation as a function of position. The maximum length for Raphanus sativus L. is obtained at x=5 mm where fluxes of electrons, ions, and photons are significantly low compared with the positions below the discharges (x<0 mm). On the other hand, The maximum lengthes for Oryza sativa and Zinnia are obtained at x=-5 mm. For Raphanus sativus L., we identify oxygen radicals play a key role in the growth enhancement, whereas electrons, ions, and photons do not. The growth enhancement is attributed not to an increase in size of each cell but to an increase in the number of cells. We also discuss briefly an indication of the change of cell activities after plasma irradiation.

Acknowledgement

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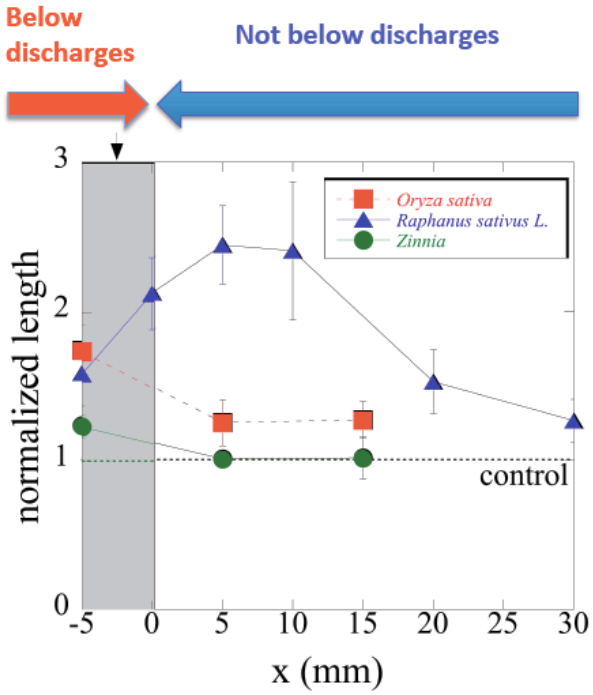

Fig. 1. Length of Oryza sativa, Raphanus sativus L. and Zinnia after 3 weeks cultivation with 50 s plasma irradiation as a function of position. The length is normalized by the length obtained without plasma irradiation.