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Optimal root arrangement of cereal crops YEONSU JUNG, KEUN-HWAN PARK, HO-YOUNG KIM[1], Seoul National University — The plant root absorbs water from the soil and supplies it to the rest part of the plant. It consists of a number of root fibers, through whose surfaces water uptake occurs. There is an intriguing observation that for most of cereal crops such as maize and wheat, the volume density of root in the soil declines exponentially as a function of depth. To understand this empirical finding, we construct a theoretical model of root water uptake, where mass transfer into root surface is modeled just as heat flux around a fin. Agreement between the theoretically predicted optimal root distribution in vertical direction and biological data supports the hypothesis that the plant root has evolved to achieve the optimal water uptake in competition with neighbors. This study has practical implication in the agricultural industry as well as optimal design of water transport networks in both micro- and macroscales.

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