

Iron Influx, Its Root-Shoot Relations and Utilization Efficiency in Wheat

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Abstract : Plant cultivars of the same species differ in their Fe efficiency. This paper studied the Fe influx and root-shoot relations of Fe at different growth stages in wheat. The four wheat cultivars (HD 2967, PDW 233, PBW 550 and PDW 291) were grown in pots in Badam Bagh agricultural researching farm, Kabul under two Fe treatments: (i) 0 mg Fe kg⁻¹ soil (soil with 2.7 mg kg⁻¹ of DTPA-extractable Fe) and (ii) 50 mg Fe kg⁻¹ soil. Root length (RL), shoot dry matter (SDM), Fe uptake, and soil parameters were measured at tillering and anthesis. Application of Fe significantly increased RL, root surface area, SDM, and Fe uptake in all wheat cultivars. Under Fe deficiency, wheat cv. HD 2967 produced 90% of its maximum RL and 75% of its maximum SDM. However, PDW 233 produced only 69% and 60%, respectively. Wheat cultivars HD 2967, and PDW 233 exhibited the highest and lowest value of root surface area and Fe uptake, respectively. The concentration difference in soil solution Fe between bulk soil and root surface (Δ CL) was maximum in wheat cultivar HD 2967, followed by PBW 550, PDW 291, and PDW 233. More depletion at the root surface causes steeper concentration gradients, which result in a high influx and transport of Fe towards root. Fe influx in all the wheat cultivars increased with the Fe application, but the increase was maximum, i.e., 4 times in HD 2967 and minimum, i.e., 2.8 times in PDW 233. It can be concluded that wheat cultivars HD 2967 and PBW 550 efficiently utilized Fe as compared to other cultivars. Additionally, iron efficiency of wheat cultivars depends upon uptake of each root segment, i.e., the influx, which in turn depends on depletion of Fe in the rhizosphere during vegetative phase and higher utilization efficiency of acquired Fe during reproductive phase that governs the ultimate grain yield.

Keywords : Fe efficiency, Fe influx, Fe uptake, Rhizosphere

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