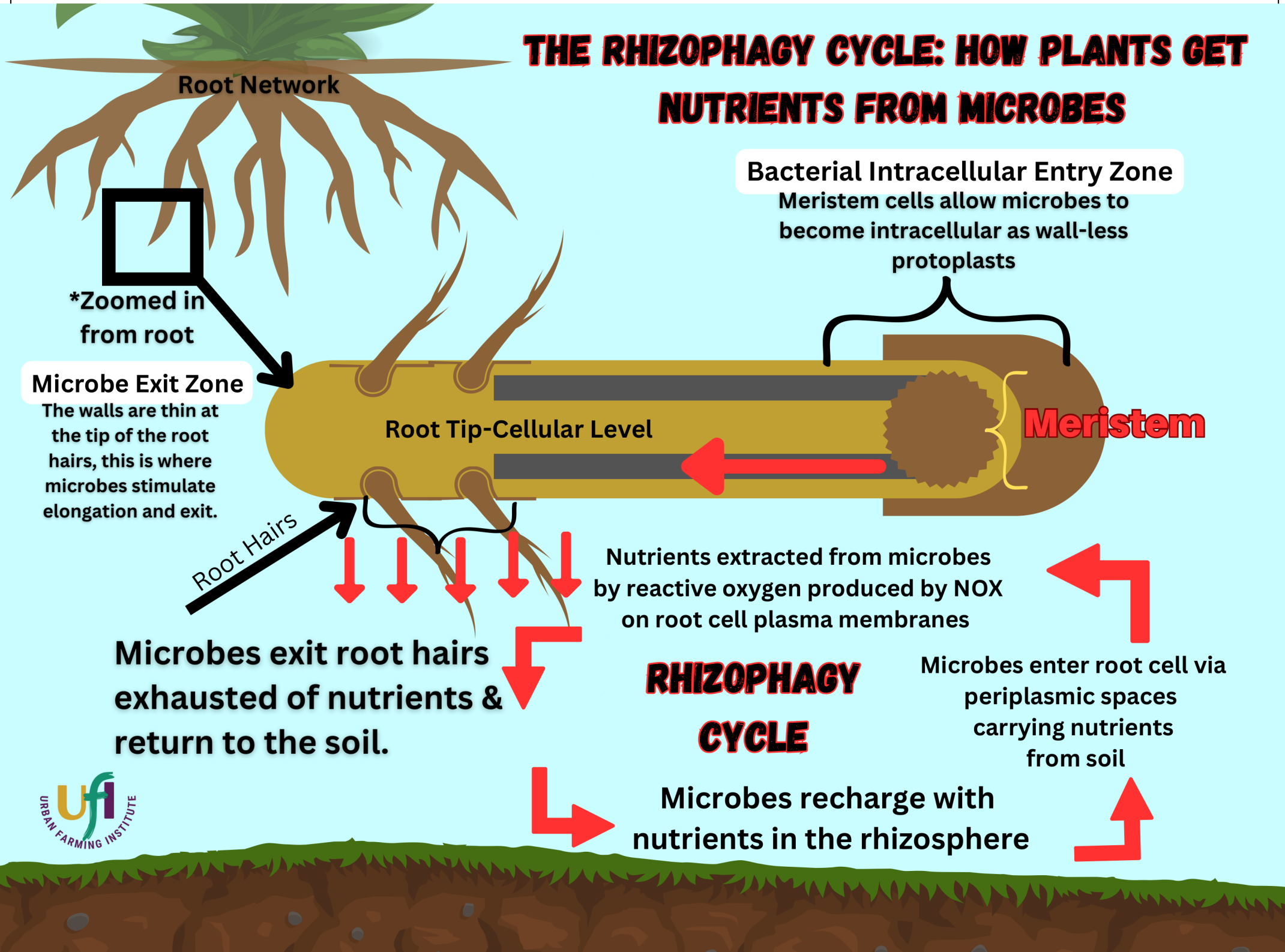


THE RHIZOPHAGY CYCLE: HOW PLANTS GET NUTRIENTS FROM MICROBES



Microbe Exit Zone

The walls are thin at the tip of the root hairs, this is where microbes stimulate elongation and exit.

Bacterial Intracellular Entry Zone

Meristem cells allow microbes to become intracellular as wall-less protoplasts

Root Tip-Cellular Level

Meristem

Nutrients extracted from microbes by reactive oxygen produced by NOX on root cell plasma membranes

RHIZOPHAGY CYCLE

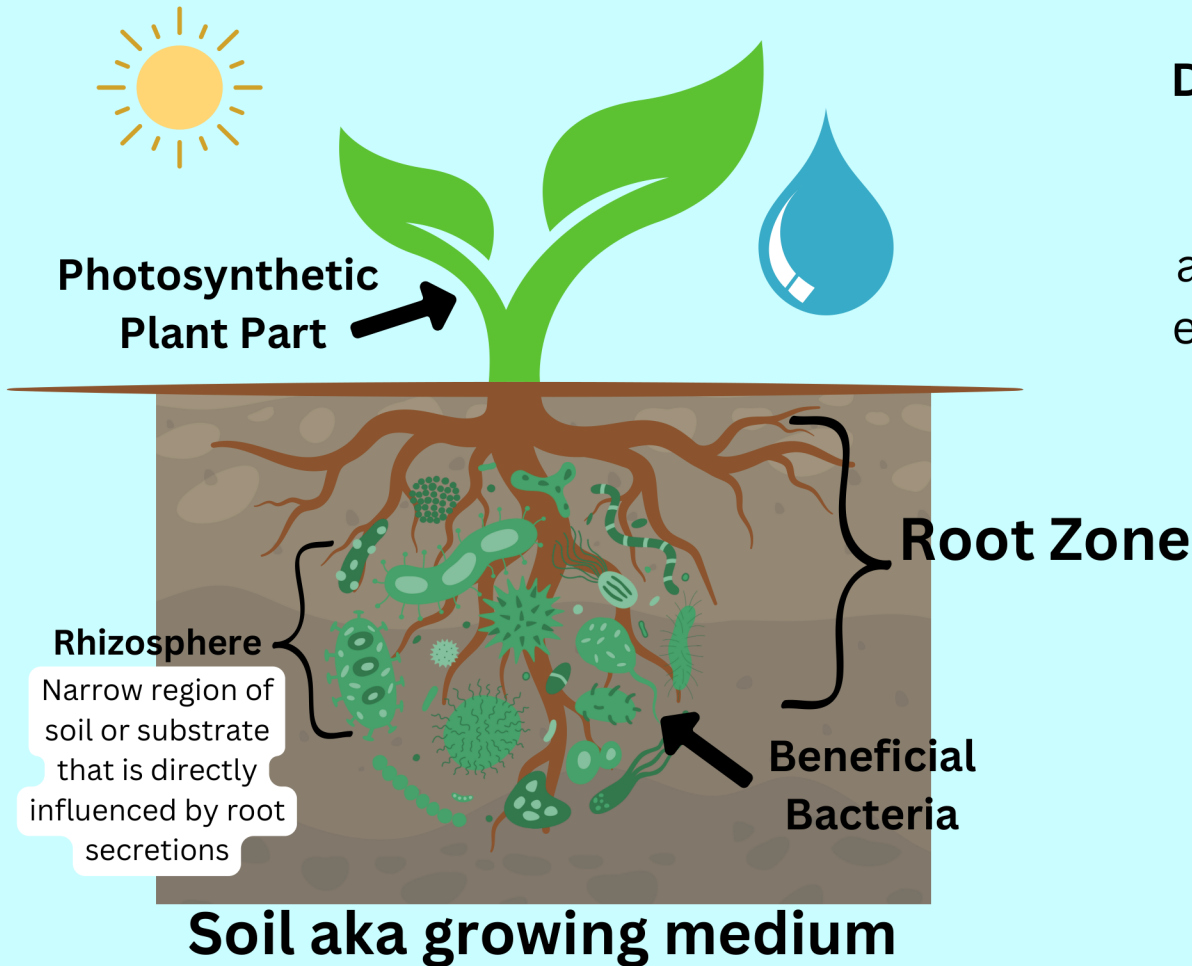
Microbes enter root cell via periplasmic spaces carrying nutrients from soil

Microbes exit root hairs exhausted of nutrients & return to the soil.

Microbes recharge with nutrients in the rhizosphere



UNDERSTANDING THE RHIZOPHAGY CYCLE



What is the hypothesized 'rhizophagy cycle'?

Definition: The rhizophagy cycle is a process whereby plants obtain nutrients from bacteria that alternate between an intracellular endophytic phase and a free living soil phase. Bacteria acquire soil nutrients in the free-living soil phase; nutrients are extracted from bacteria oxidatively in the intracellular endophytic phase.



Root tip of Bermuda grass (*Cynodon dactylon*) showing a cloud of bacteria (*Pseudomonas* sp.) around the root tip at the site of endophytic penetration into root tissues. The brown coloration is due to presence of hydrogen peroxide in cells where bacteria penetrate roots (stained with diaminobenzidine tetrahydrochloride).

Information adapted from: White, James & Kingsley, Kathryn & Verma, Rajan & Obi, Nkolika & Dvinskikh, Sofia & Elmore, Matthew & Verma, Satish K. & Gond, Surendra & Kowalski, Kurt & Zhang, Qiuwei. (2019). Review: Endophytic Microbes and Their Potential Applications in Crop Management. *Pest Management Science*. 75. 2543-2548. 10.1002/ps.5527.