

Earth's natural fertilizer: Foliar uptake of insoluble phosphorus from desert dust stimulate plant growth

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Phosphorus (P) scarcity constrains plant growth in many ecosystems worldwide. Thus, plants that grow on P impoverished soils have evolved specialized functional traits to acquire P through root adaptations. Here we describe an unrecognized P acquisition trait which is decoupled from the soil-root system and may play a large role in plant nutrition globally. In a greenhouse experiment we found that the growth of plants that naturally evolved in ecosystems downwind to deserts (chickpea, wheat and maize) is enhanced by 30 to 80 % through foliar uptake of P from desert dust deposited on their leaves. In addition to P, dust also transferred substantial amounts iron (Fe) and Potassium (K) to the plants. To maximize dust P uptake, plants have actively modified the morphology and chemical environment of their leaf surfaces in response to P starvation. These modifications increased leaf dust retention and promoted solubilization of insoluble mineral P which is considered unavailable according to theory. Our results suggest that 'foliar dust traits' enable plants in dusty regions to acclimate to nutrient poor conditions. As both P limitation and dust deposition are projected to increase due to global environmental changes, plants adopting dust traits may gain competitive advantage over other species.