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Review Article

Screening of Wheat and Barley Varieties Roots Exudates

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Abstract

Root exudates is important as protective slim mucilage compound as it is genetic material contradict the surrounding soil environment to facilitate acquisition of nutrient. Root stamp method is developed method of Uren root print method to detected the redox material which help the nutrient micro element availability in alkali and calcareous soils.

Keywords: Wheat; Barley; Roots Exudates

Preface

This article is not classic research paper but is hypotheses needs more team researches, soil specialist, plant breeders and plant physiologist.

Introduction

Life on Earth is sustained by a small volume of soil surrounding roots, called the rhizosphere. The soil is where most of the biodiversity on Earth exists, and the rhizosphere probably represents the most dynamic habitat on Earth; and certainly is the most important zone in terms of defining the quality and quantity of the Human terrestrial food resource. Despite its central importance to all life, we know very little about rhizosphere functioning, and have an extraordinary ignorance about how best we can manipulate it to our advantage.

Root exudates role in nutrient acquisition

Root exudates are a class of root products which a plant introduces into the soil and which are known or hypothesized to influence plant and soil processes including nutrient acquisition. These products may constitute as much as 20%, or perhaps even more, of a plant's photosynthetically fixed carbon. Their nature, amount, source, and persistence vary both longitudinally and radially away from the root tip. They influence nutrient solubility and uptake indirectly through their effects on microbial activity, rhizosphere physical properties, and root growth patterns, and directly by acidification, chelation, precipitation, and oxidation-reduction reactions.

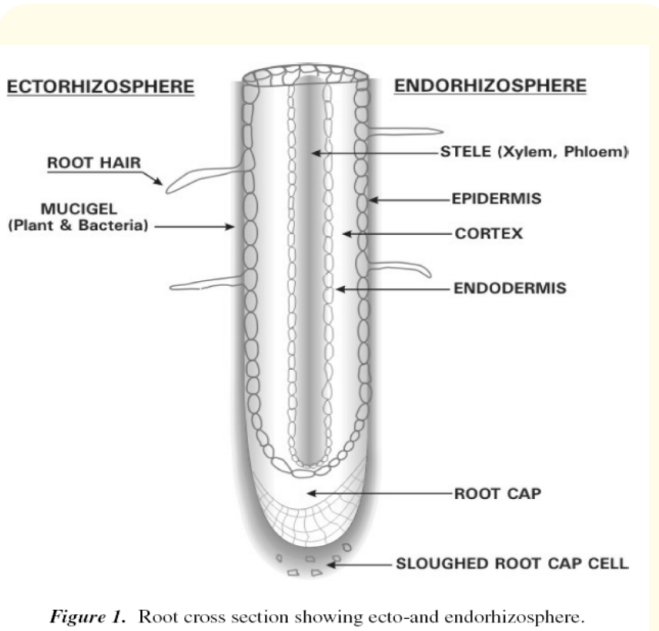

Figure 1. Root cross section showing ecto-and endorhizosphere.

Figure 1: Root cross section showing ecto-and endorhizosphere.

Root products

Root exudates include a wide variety of compounds released from different parts of root systems and presumably for different reasons. They are compounds that emanate from intact cells and include, in addition to mucilage and low molecular weight organic moieties, gases such as carbon dioxide and ethylene, nutrient ions, bicarbonate ions, protons, and electrons. Root exudates may either leak from or between epidermal cells, be actively excreted (excretions), or be actively secreted (secretions).

Diffusates

Root exudates that leak or diffuse out of roots in response to concentration gradients. They leak from sites such as the junctions between intact epidermal cells and represent possible leakage of photosynthate via an apoplastic pathway which would be stimulated or enhanced simply by microbial growth or any other processes that maintain or accentuate activity gradients.

Excretions

Root exudates that are actively excreted, to facilitate internal metabolism. For example, carbon dioxide, an end product of respiration, is actively eliminated from root cells. Excretions also include exudates such as protons involved in the active uptake of ions.

Root debris

Root debris consists of discarded root-cap cells and lysates, which are the products of cell autolysis.

Rhizosphere

Rhizosphere is the layer of soil that surrounds a plant root and whose properties have been modified by plant processes including the release of exudates, absorption and deposition of nutrients, removal of water, physical forces, etc.

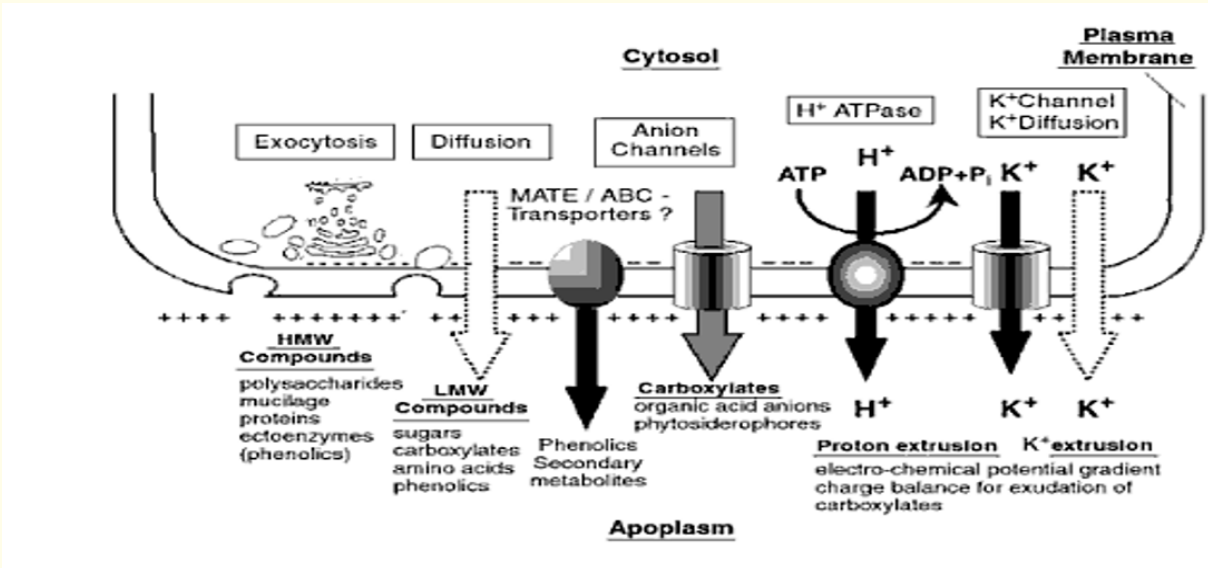

Figure 2: Model for mechanisms involved in the release of root exudates..

Phytosiderophores

Phytosiderophore is Root exudates of Monocotyledon plant graminaceae like wheat and barley facilitated iron uptake which is called Strategy I plant.

Strategy II plants are for Dicotyledonous plant.

Calcareous soils

Soils with lime more than 15% called calcareous soils, it's have huge buffering system depending on equilibrium between lime and active lime, Problems of alkali soils especially calcareous soils is the availability of Fe, Zn, p.

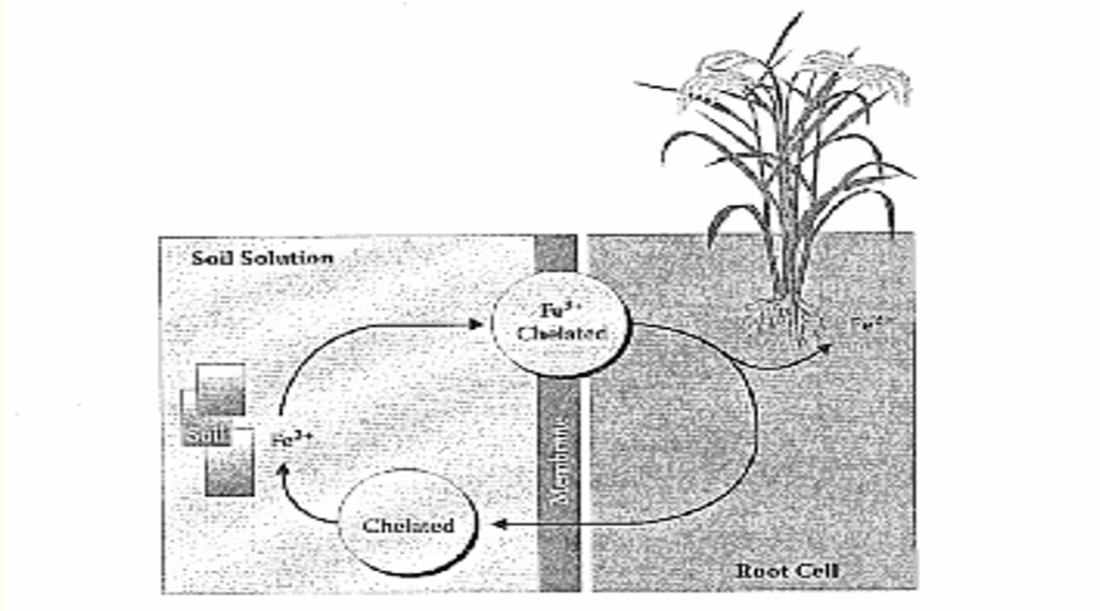

Figure 3: Mechanism or iron uptake in chelated form by monocotyledonous plant (Strategy II). Adapted from Fageeia., et al. (2003)and Brady and Well (2002)..

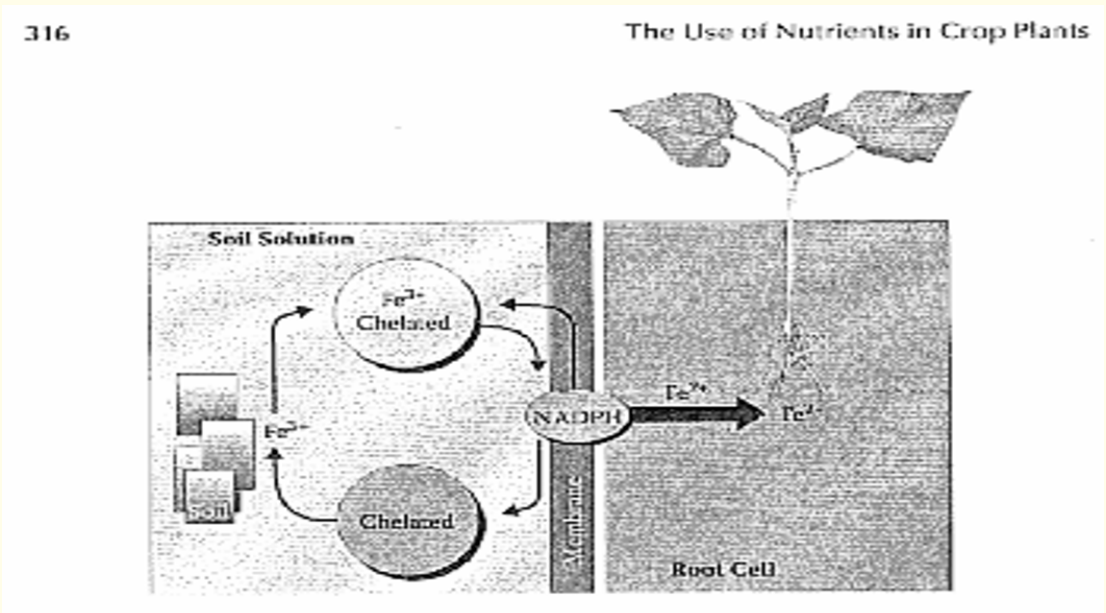

Figure 4: Mechanism or iron uptake in chelated form by dicotyledonous plant (Strategy 1). Adapted from Brady and Well (2002).

Iron Chlorosis is a worldwide problem, particularly in semi-arid (250 - 500 mm) regions containing calcareous soils. Although most soils contain adequate total iron, the amount available to the plant is dependent on many factors such as iron species and plant Genotype.

Germoplasma adapted to calcareous soils overcome this deficiency.

Alfesols

Problems of acidic soils AS, alfesols soils is the toxicity of Al and Fe.

Germoplasma adapted to acidic soils overcome this toxicity.

In the FAO soil classification, most Alfesols are classified as Luvisols or Lixisols, but some are classed as Nitisols [1].

Root exudates as indicators of plant reaction to acid and nitrogen inputs into forest ecosystems.

The role of root exudates in aluminium tolerance of Norway spruce (related Ph. D project) Jörg Luster (Project leader), Emmanuel Frossard (ETH Zürich), Ivano Brunner.

Hypothesis

Objectives of project are based on the following hypothesis:

- Forest trees react to acid or nitrogen induced changes in the chemical composition of the rhizosphere soil solution by altering the chemical composition of the root exudates.
- The emphasis in the first project phase is on the reaction of trees to high aluminum concentrations as they occur in acidic soils.

World Soil Resource

The soils of the world are either alkali or acidic, related to weather and parent material which reflect the chemical characteristics especially the PH and redox potential. So, there are acidic soils in the world as much as the alkali soils, as a result the germoplasma adapted to acidic soils as much as the germoplasma adapted to alkali soils. As example we import many high product wheat varieties which adapted to acidic soil trying to get the same potential in our calcareous soils but we get maximally the half product.

Figure 5

Plant roots adaptation to soils

The roots of plants adapted to alkali soils with high calcium carbonate and calcium ion (calcareous soils) can be more acidic and its redox value negative (reduced) (soils like the most Iraqi soils especially Aljazera area around mosul).

The exudates of roots adapted to acidic soils are more alkali and its redox value is positive (oxidized) especially in the soils of cold rainy environment and soil around equator.

Genetic manipulation

Breeder's project begin with germoplasma lines some of them are adapted to acidic soils (Aerosols, Histosols, and Podzols etc.) so these lines from the beginning we must eliminate them if the breeder work in Iraq or on alkali soils and he intends to apply the genetic manipulation on his work its (meaning no uses any kind of fertilizer especially micronutrient fertilizers) the root exudates will optimize uptake of nutrients.

Screening methods

The (Sandwich technique) method [2-5] is developed to Root stamp [6] which is easier but the both did not give the sum of reactions and activations of the whole root, so another method was invented to calculate the sum of reaction by using PH-Redox device the method called Reduction capacity [6].

Procedure

Germination of 14 equal seed on circular cotton sheet, saturated it with 0.5 Hoagland solution (-Fe), after the formation of root net we raise the layer of (cotton + seedling) and inserting filter paper treated with 0.01M K-permanganate under the cotton sheet. After 10 days we can examine the root stamp on the filter paper.

Root stamp

Root stump of wheat and barley root varieties: white spots is reduction effect of root exudates (loss of permanganate pigmentation).

Figure 6

Root print of Uren (Sandwich technique)

Figure 7

Conclusion

Many important crops failed in calcareous soils, like lupine and soy bean verities, wheat important varieties did not give its potential product as in its original soil area because of its root exudates has been adapted to another soil environment.

Difficulties of studying root exudates was important factor to delay the reality about its important role of nutrient acquisition as genetically important material and the uses of fertilizers threading it.

Bibliography

1. FAO. "World soil resources, reports No. 66" (1991).
2. Uren NC. "Chemical reduction of an insoluble higher oxide of manganese by plant roots". *Journal of Plant Nutrition* 4.1 (1981): 65-71.
3. Uren NC. "Chemical reduction at the root surface". *Journal of Plant Nutrition* 5.4-7 (1982): 515-520.
4. Uren NC. "Forms, reactions and availability of iron in soil". *Journal of Plant Nutrition* 7.1-5 (1984): 165-176.
5. Uren NC and HM Reisenauer. "The role of root exudates in nutrient acquisition". In: B Tink and A Lauchli (eds). Advances in plant nutrition (1988): 79-114.
6. Almalak SD. "Reduction capacity of roots in certain wheat varieties and its relation to iron absorption". Ph. D thesis/ University of mousl (2001).

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