Screening biostimulants to promote wheat productivity & its rhizomicrobial communities

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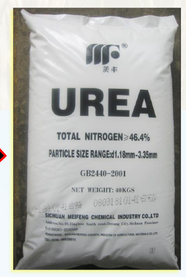
Introduction

Wheat (*Triticum* spp.)



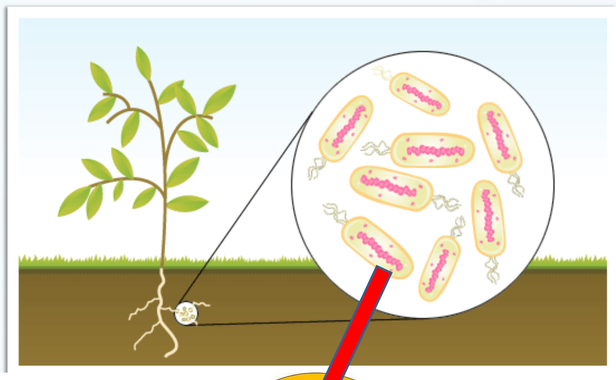
Today's chemical fertilizer problem:
- Soil & water pollution
- Greenhouse-gas generation
- High cost

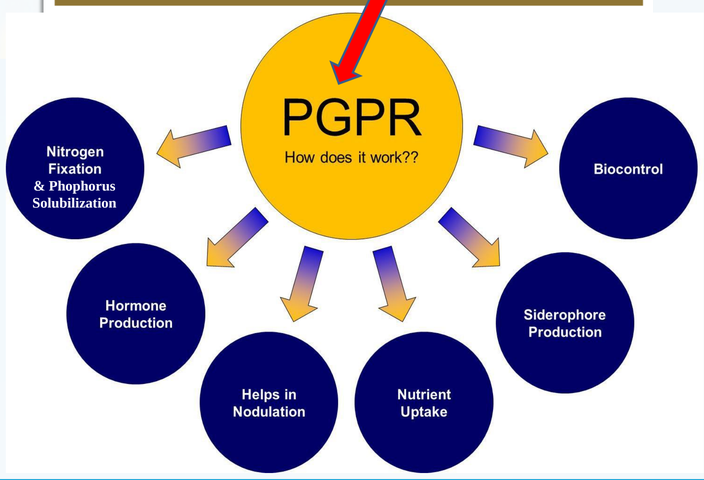
BIOSTIMULANTS

Use of biostimulant products based on beneficial microorganism to replace partly or completely chemical fertilizers

Biostimulants are compounds, substances and microorganisms that are applied to plants or soils to regulate & enhance the crop's physiological processes in order to make them more productive. At least 8 classes of compound-based biostimulants exist, including humic substances, complex organic materials, beneficial chemical elements, inorganic salts, seaweed extract, chitin and chitosan, antitranspirants, free amino acids & other N-containing substances[(3, 4)].

In parallel, biostimulants may also include **living microorganisms** like plant growth-promoting fungi (PGPF) and **rhizobacteria (PGPR)**[(1, 2)]. Our present study will first focus on this last class of products.





Objective

Development of relevant research tools:

- To stimulate the increase of **beneficial microorganism communities** and the decrease of pathogenic ones in the wheat rhizosphere
- To assess the impacts of such changes on **plant growth, tolerance to abiotic stresses** & **soil fertility**
- To figure out the best agronomical practices to stimulate the beneficial microbial communities under different productions system

Materials

- Collection of PGPR strains in Laboratory belongs to genera: *Azotobacter*, *Pseudomonas*, *Azospirillum* & *Bacillus*
- Commercial products with clear application instruction: TwinN (diazotrophic bacteria); NitroGuard (TwinN + 2 *Bacillus* trains); FZB24 fl (*Bacillus subtilis*); Rhizocell GC (*Bacillus* sp. IT45); RhizoVital 42 (*Bacillus amyloliquefaciens*)

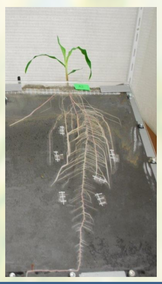
Experimental Design

Spring wheat
GREENHOUSE TRIALS

Step 1 — Screening for effects on young plantlets (3 weeks)

Step 2 — Screening for yield-relevant effects (until flowering)

Step 3 — In depth characterization of the effects induced by the 3 best candidates (Rhizotron studies, set up of analytical tools)



Rhizotron

Winter wheat
FIELD TRIALS

Preliminary field trial using commercial products

Measured variables

1. Whole plant and root physiology
- Biomass weight, length, and yield
- Grain: protein, uptaked N, P, N…
- Photosynthesis efficiency
- Oxidative markers to abiotic stress (e.g. drought)

2. Soil fertility changes: organic matter, mineral composition (N, P, K, Fe, Cu…)

3. Soil microbial community based on **metagenomic tool** (shotgun sequencing of rDNA)

Validation of the growth promotion under realistic field condition using the top 3 candidates with various application schemes, e.g. in combination with N-fertilizer (0, 50, 75, & 100%)

References
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