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BE-assisted P nutrition of wheat supplied with rock phosphate & placed NH_4^+

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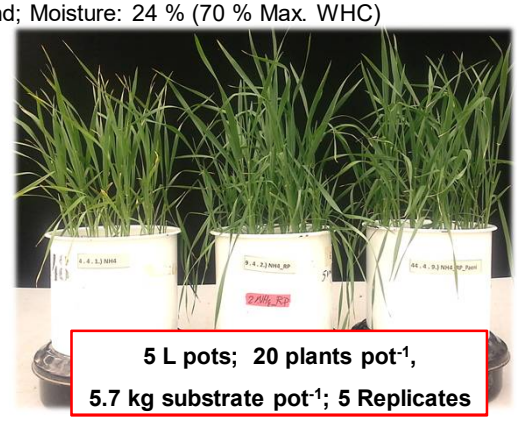
1. Objectives

To improve nutrient acquisition and yield of wheat plants supplied with rock phosphate and placed NH_4^+-fertilizer by inoculating the substrate with *Plant Growth-Promoting Microorganisms* termed Bio-effectors (BEs). To also investigate the effect of NO_3^-.

2. Methodology (Pot experiment)

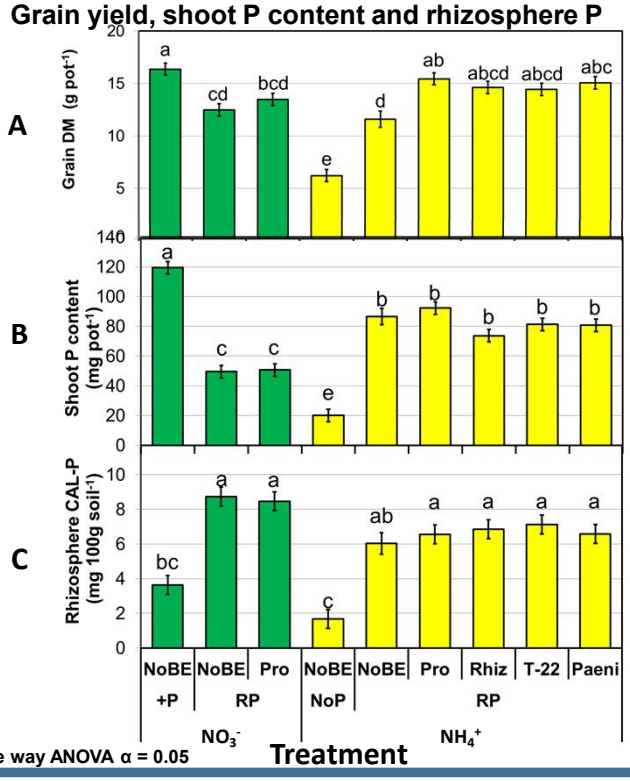
- **Wheat** (*Triticum aestivum L.* Schirocco, KWS, Germany),
- **Substrate:** 70 % Low-P silt loam luvisol (Barvendorf): pH 6.4 ; CAL-P, 7mg kg^{-1}; 30 % sand; Moisture: 24 % (70 % Max. WHC)
- **BEs:** None (**NoBE**), *Pseudomonas sp.* DSMZ 13134 Proradix (**Pro**), *Bacillus amyloliquefaciens* FZB42 Rhizovital (**Rhiz**), *Paenibacillus mucilagenosus* (**Paeni**) (1x10^9 CFUs or Spores kg^{-1}); *Trichoderma. harzianum* T22 (**T-22**, 1x10^8 spores kg^{-1}) three inoculations at 0, 24 and 34 days after sowing (BE suspended in N soln. at 24 DAS)
- **P**: 0 (**NoP**),150 mg kg^{-1} soil ($Ca(H_2PO_4)_2$ **+P**; rock phosphate 7.6 % P, **RP**)
- **N**: 150 mg N kg^{-1} soil ($Ca(NO_3)_2$, **NO_3^-**) or $(NH_4)_2SO_4$+NI DMPP, **NH_4^+**), split fertilization (1/3): 0, 24 and 42 DAS
- **Greenhouse/Outdoors**: 02. Jun – 04. Sep. 2015; Av. daily temp.: 24°C (min: 8 °C, Max: 51 °C); Daylight intensity: 400-1200 µmol. photons m^{-2} s^{-1}



5 L pots; 20 plants pot^{-1}, 5.7 kg substrate pot^{-1}; 5 Replicates

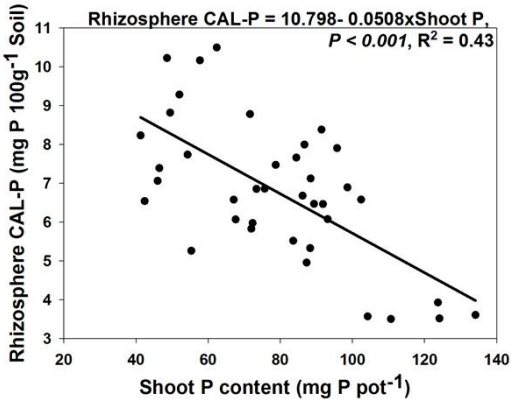
3. Results

3.1 Grain yield, shoot P content and rhizosphere P



One way ANOVA α = 0.05

3.2 Available rhizosphere P reduced with increasing shoot P content



3.3 BE effects for each N-form

Variable	NO_3^-		NH_4^+				
	NoBE	Pro	NoBE	Pro	Rhiz	T-22	Paeni
Root DM (g pot^{-1})	1.28	1.23	1.23	1.74	1.60	1.35	1.64
Shoot DM (g pot^{-1})	29.7	31.3	28.2	35.5	32.7	33.3	33.5
Nr. of grains	440	480	332	453**	442*	422*	460**
TGW	28.0	27.6	33.7	33.8	32.6	33.9	31.9
Grain P (mg pot^{-1})	38.5	41.0	63.9	72.3*	59.1	62.2	65.9
Straw P (mg pot^{-1})	10.9	9.6	23.6	19.9	14.5**	19.1	14.7**

t-test, α = 0.05; * *P<0.05*, ***P<0.01*

4. Conclusions

- Inoculation of Proradix (*Pseudomonas sp.* DSMZ 13134) or *Paenibacillus mucilagenosus* led to increased grain yield.
- Generally, NH_4^+ > NO_3^- and BE > No BE to improve the contents and/or concentrations of nutrient in the shoot or grain.
- Improvement of nutrient status and yield of wheat plants may be explained by enhanced chemical mobilization/solubilization of nutrients in the rhizosphere and by root interception of nutrients.

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