



The role of balanced macro- and micronutrient intake in improving stress resistance of plants

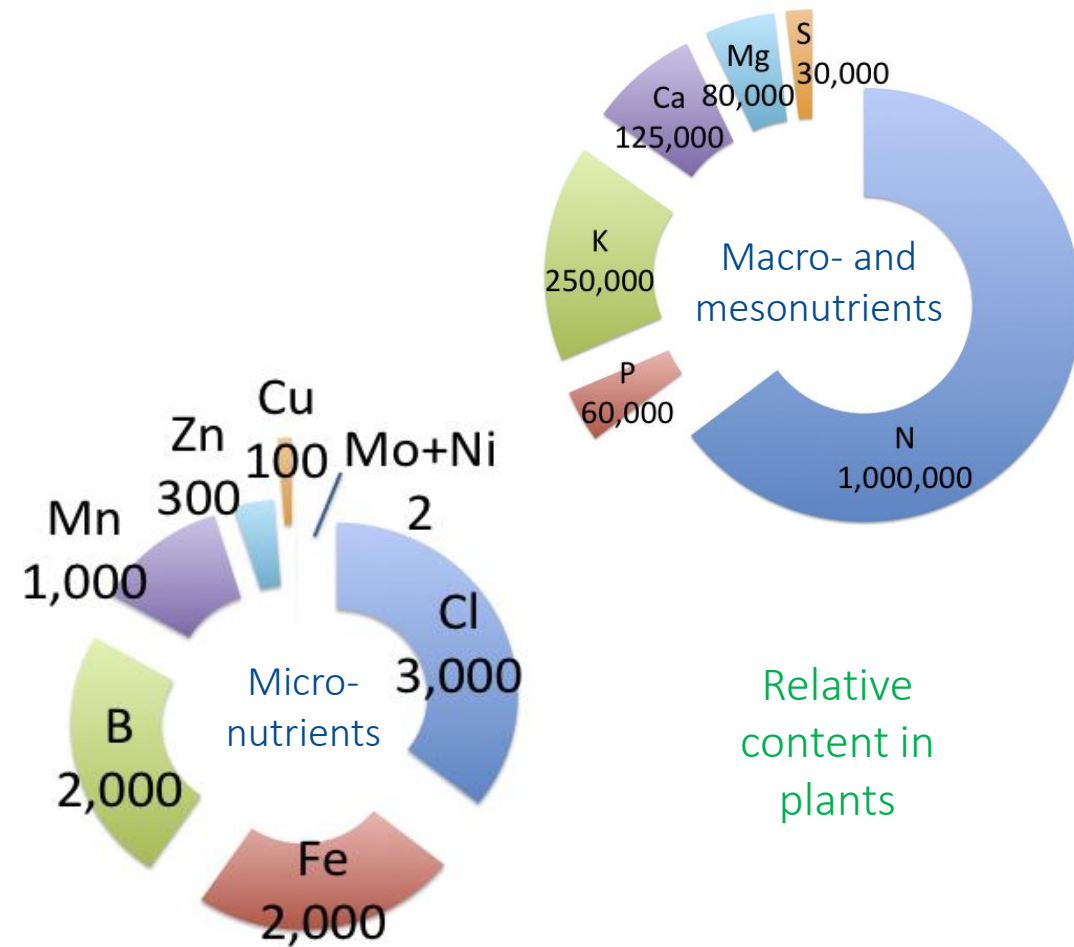
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Each nutrient performs its own functions in the plant

- 14 of the 17 nutrients essential for mineral nutrition of plants come from the soil
- Micronutrients are as important as macronutrients, but plants need them in much smaller amounts

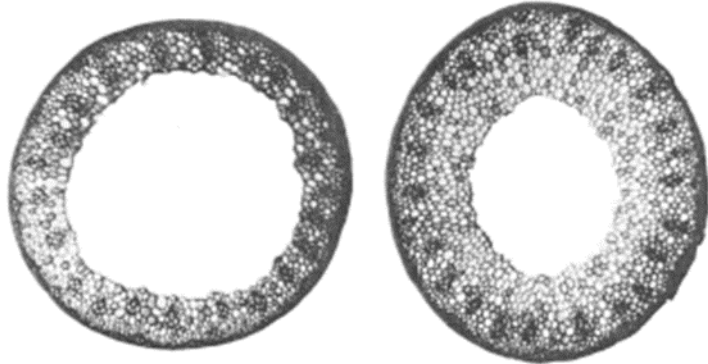




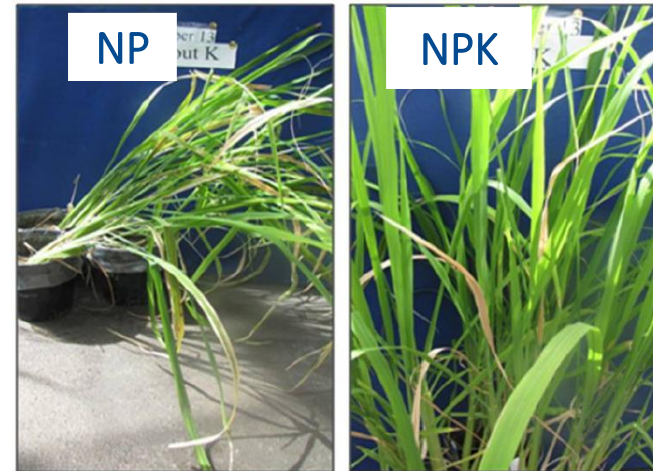
Lodging resistance in cereals

Low K

Optimal K



Cross-section of a wheat stem (3rd internode) with insufficient and optimal K levels.



84 days after planting rice seedlings in a pot trial.

Balanced nutrition in cereals increases the thickness of straw walls, which improves lodging resistance.



Improving the water regime of apple leaves

Trial option	Water content of leaves, %			Water loss from leaves, %		
	July	August	September	July	August	September
N ₁₃₀ P ₆₅ K ₆₅	59,4	58,9	54,0	12,6	8,7	6,8
+ K ₃₀ (dressing)	61,0	61,3	55,6	8,8	5,6	5,2
LSD ₀₅	1,0	1,0	1,3	–	–	–

Trial at the Kuban State Agrarian University, on leached chernozem without irrigation (trial started in 2002). Mean data for 2009-2011. K dressing in June. Variety: Florina; rootstock: MM106. Water loss from leaves: 2 hours after cutting.

Source: T.N. Doroshenko et al., 2012



Pest and disease resistance: mechanisms

- Improved strength of plant tissues and thickness of cell walls and cuticle (a protective waxy layer in leaves, stems, and fruits). Positive effect on the synthesis of phenolic compounds (the basis of many plant defense mechanisms) and arginine (an amino acid toxic to the pathogen that causes Phytophthora blight).
- “Nutritional” mechanism: plant cells do not accumulate low molecular weight soluble organic compounds, which provide a favorable environment for pathogenic microorganisms and pests.
- Direct inhibitory effect of potassium salts on the development and reproduction of pests and pathogenic microorganisms.



Brown rust of wheat
L.A. Mikhailova (All-Russian Research
Institute of Plant Protection), 2008.
Agroatlas

Source: adapted from S. Perrenoud, 1990; V.V. Prokoshev and I.P. Deryugin, 2000; P. He et al., 2006



Micronutrients: zinc

- Zn plays a key role in plant resistance to diseases and pests. Several studies have found that zinc fertilizers improve plant resistance in the majority of cases.
- Improved plant resistance to pests and diseases includes various mechanisms involving zinc. These include two mechanisms closely associated with zinc: counteracting oxidative stress and regulating zinc finger protein domains.



Zinc deficiency in wheat (photo: M.K. Sharma and P. Kumar)



Thank you!