Can Foliar Fertilization Improve Crop Yield?

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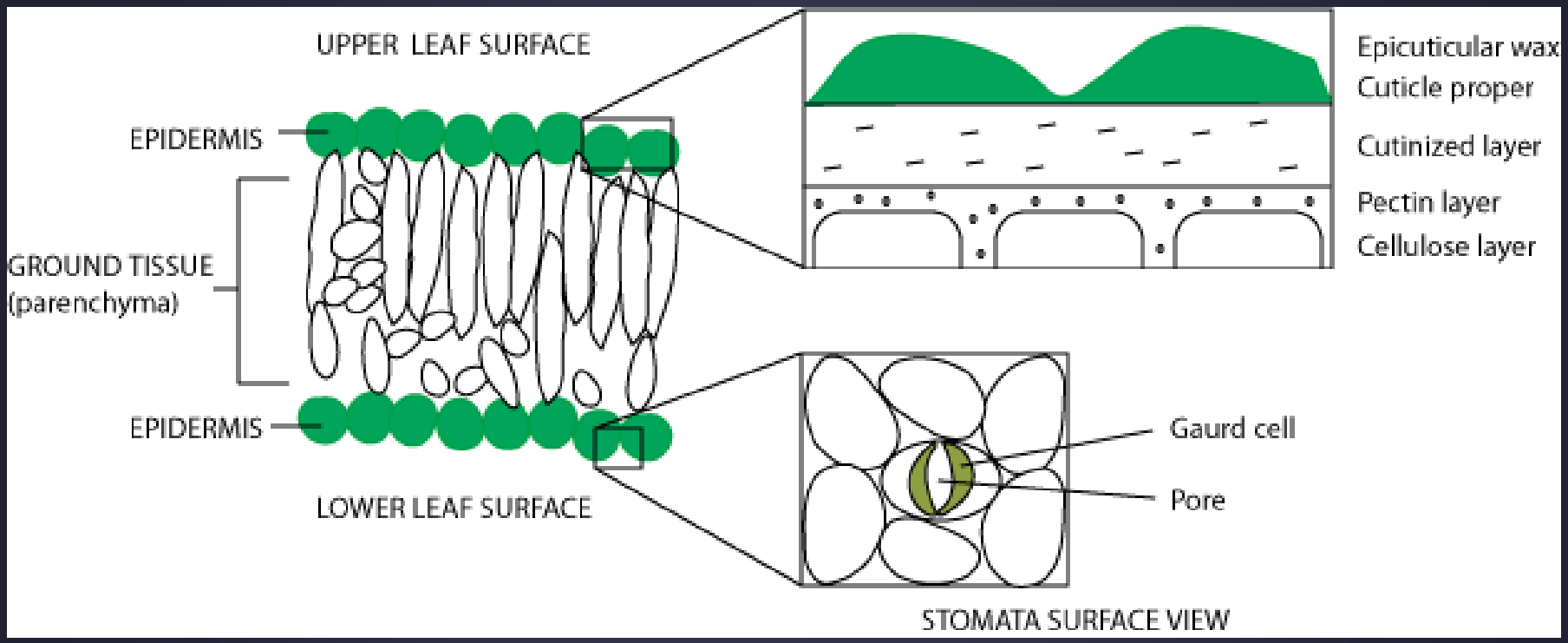
Objective

- Highlight what is known about nutrient absorption by leaves
- Overview of performance of foliar fertilizers

Nutrient Uptake by Leaves

- Not a primary function of leaves



Foliar Uptake Affected By:

- Low nutrient penetration rates
  - Particularly thick cuticles
- Runoff from hydrophobic leaf surfaces
- Washing off by rain
- Rapid drying of spray solutions

From Marschner, 1994

Foliar Uptake Affected By:

- Limited rates of translocation
- Limited amounts of macronutrients that can be supplied in one application
- Leaf damage

From Marschner, 1994

Situations Where Foliar Fertilization May Be Beneficial

- Soils where nutrient availability may be low
  - Mn/Zn on soils with high pH or high OM
- Dry topsoil limiting nutrient availability
  - Particularly arid regions
- Onset of reproduction when root activity decreases and nutrient uptake is reduced

From Marschner, 1994

Initial Positive Field Results

- Garcia & Hanway (1976)
  - Iowa
  - N-P-K-S at R4 & R5, R5 & R6, or R6 & R6.5
  - Soybean yield increases
    - 1.2 – 8.0 bu/A

Early Mixed Results

- Gray & Akin (1984)
  - Average soybean yield decreased 5.2 %
  - Over locations in 28 states
- Parker & Boswell (1980)
  - 10.9 and 17.6 % soybean yield decrease
- Harder et al. (1982)
  - Application of N-P-K-S after silking
  - Temporarily reduced photosynthesis
  - Corn yield reduced by 6.4 %

Recent Results: Corn

- Rehm (2003) – Minnesota
  - 1 to 3 applications of 25, 12.5, 6.3 and 1.0 lb/a of N, P_2O_5, K_2O, and S after silking
  - Yield changed -5.8 to +4.7 bu/a (not significant)
- Sawyer & Barker (1999) – Iowa
  - Four treatments
    - 0 or 5 lb/a 0-52-34
    - 0 or 1.7 lb/a 45-0-0
  - Applied at V6-V8, V12-V14, or 50 % VT
  - Significantly greater grain yield without 0-52-34
    - No other effects significant

Recent Results: Soybean

- Rehm (2003) – Minnesota

Nutrient applied				Location		
N	P_2O5	K_2O	S	Waseca	Becker	Rosemount
---------- lb/a ----------				---------- bu/a ----------		
0	0	0	0	57	53	59
40	4	12	3	56	54	57
80	8	24	6	59	50	59
80	8	24	6 + micros	54	45	56

Soybean yield average of 2 varieties. Applied during pod fill.

Recent Results: Soybean

- DiFonzo & Laboski (2004) – Michigan
  - 2 qt/a of 10-10-10 + B, Fe, Mn, Zn, Mo
    - At R3 and R5
  - Yield changed -3.3 to +0.8 bu/a
    - But not significantly different than control
  - Break even yield increase = +3.1 bu/a
  - Locations with greatest yield decreases coincided with most evenly distributed rainfall

Summary

- Foliar fertilization may increase or decrease yield
  - Conditions under which yield increase is assured are unknown or not predictable
- Lack of economic yield responses
- ***Widespread practice of foliar fertilization is not recommended***