

Silicon Fertilization – What's up with THAT?

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What's an essential element?

- Plant needs it to grow and reproduce (complete life cycle).
- Nothing else can substitute for it.

Essential Elements (17)

Carbon

Hydrogen

Oxygen

Nitrogen

Phosphorus

Potassium

Calcium

Magnesium

Sulfur

Iron

Molybdenum

Copper

Manganese

Chloride

Boron

Zinc

Nickel

'Quasi' Essential Elements

- **Silicon** — considered a beneficial substance by the AAPFCO
- **Cobalt**
- **Aluminum**
- **Vanadium**

So.....Silicon

- Proven links to disease suppression.
- Possible links to improving turfgrass wear.
- Possible links to leaf blade stiffness and better ball roll.

How does it get into the plant?



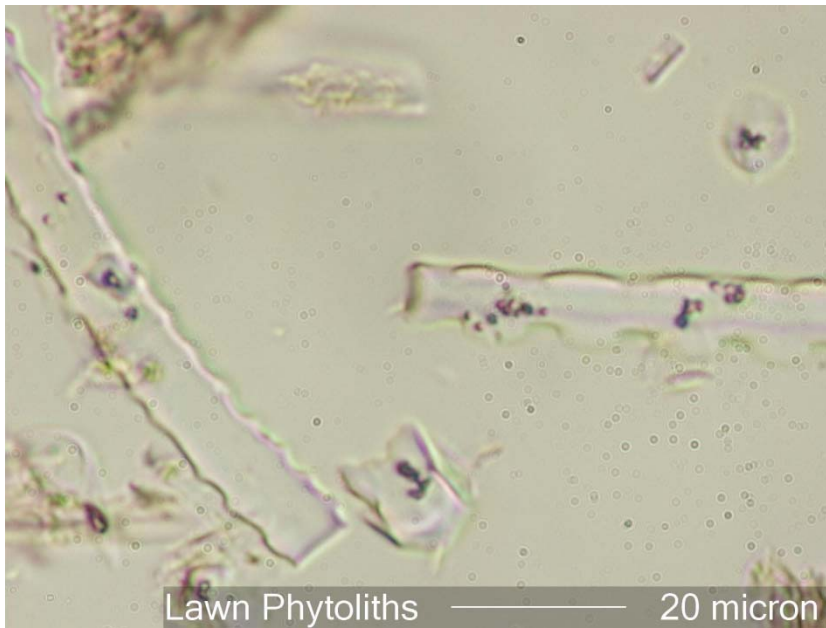
Actively



Passively

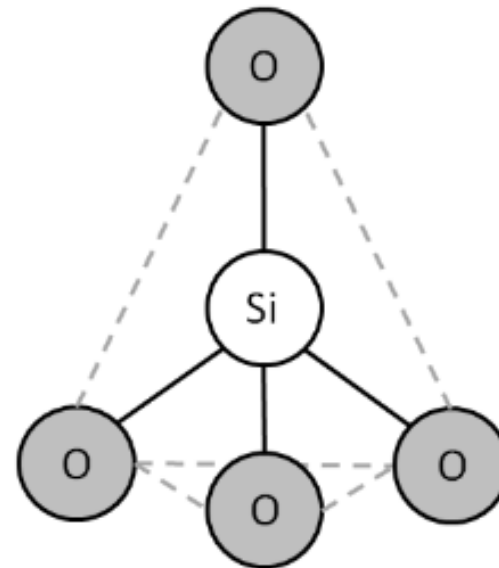
Where does plant Si come from?

ORGANIC



<http://www.microlabgallery.com/gallery/PhytolithsLawn3.aspx>

INORGANIC



WHY silicon? What does it do in the plant?

- Mechanical barrier – Si beneath cuticle/in cell walls.
- Faster and stronger activation of defense genes/defense enzymes.
- Photosynthesis/anti-oxidant systems improved.

Debona, Rodrigues and Datnoff, 2017

Which Plants?



How did we get to turfgrass?

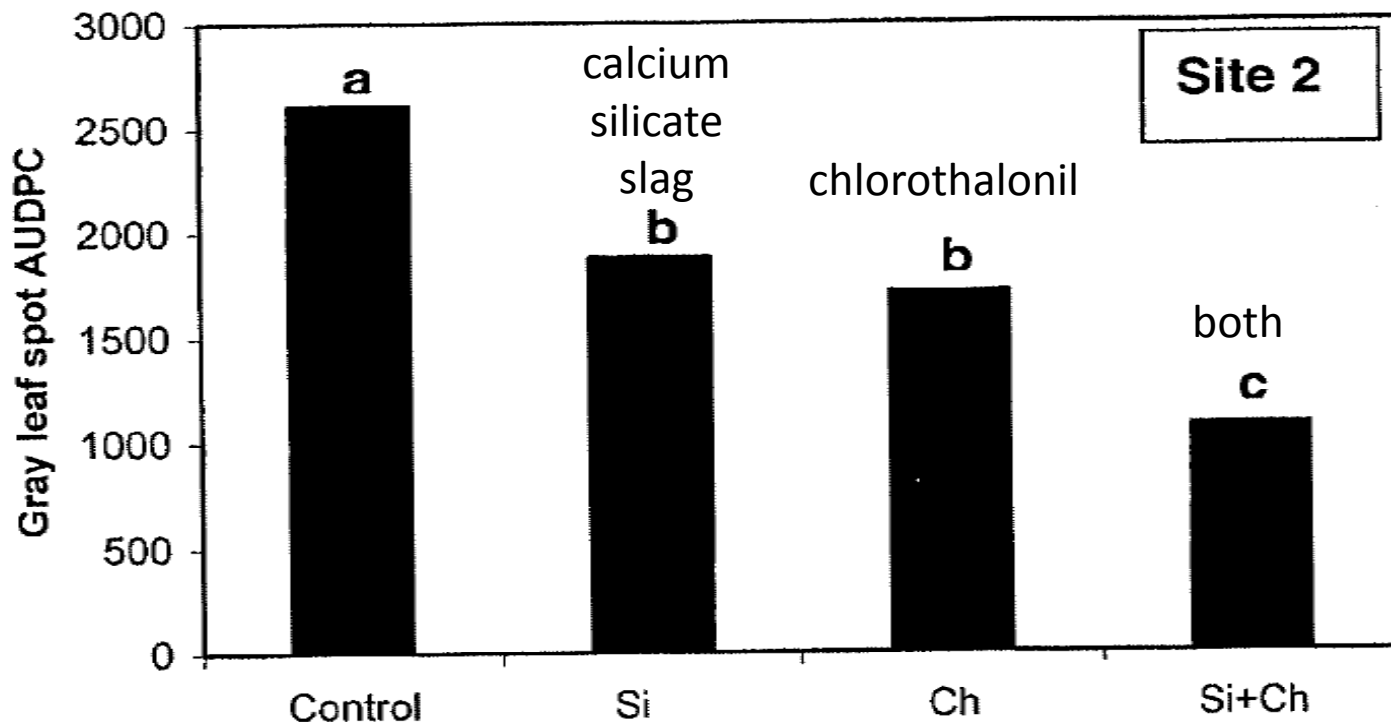
Magnaporthe grisea – rice blast



Pyricularia oryzae (*Magnaporthe grisea*) – gray leaf spot

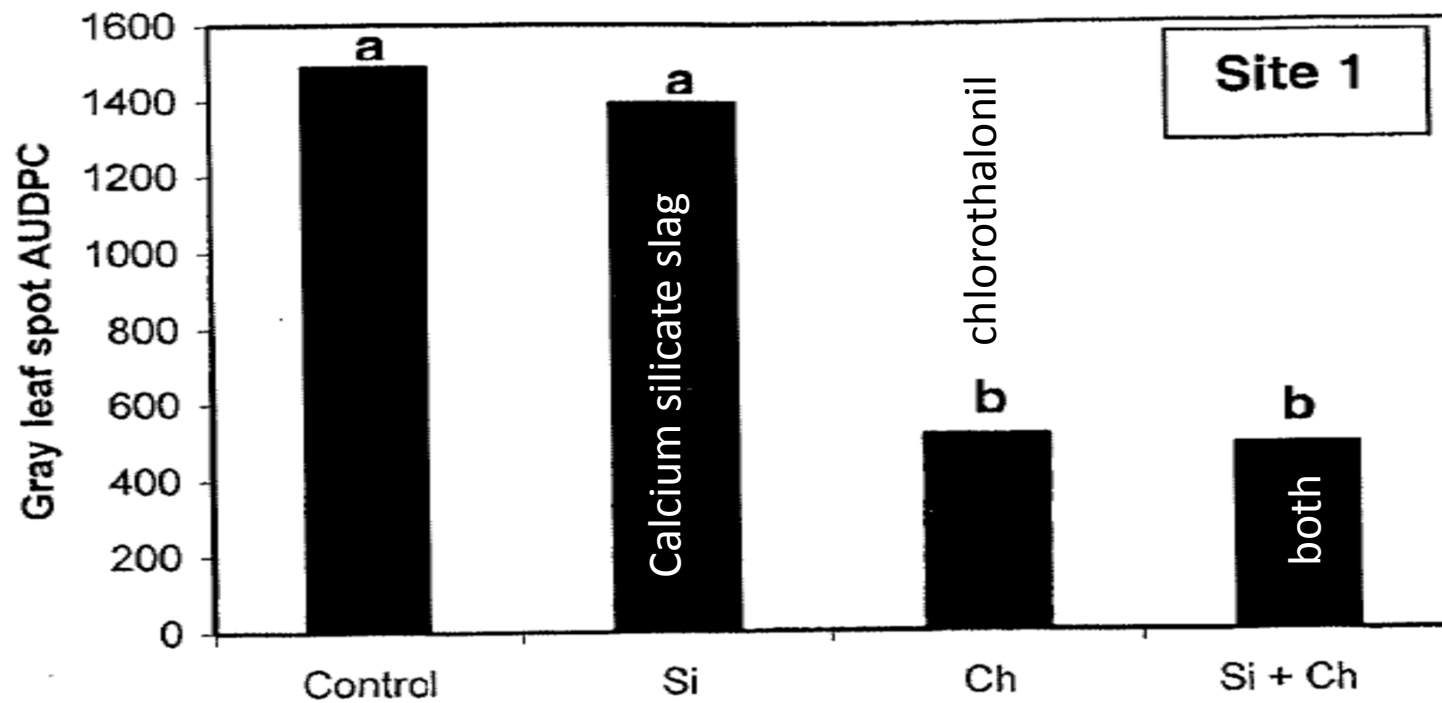


Does Si help reduce GLS?



Brecht, Datnoff, Kucharek & Nagata, 2004

Does it always work?



Brecht, Datnoff, Kucharek & Nagata, 2004

What about turfgrasses we use in golf?

Turfgrass	Disease	Reduction?
Zoysiagrass	Leaf blight	Y
Creeping bentgrass	Root rot, brown patch, Dollar spot	Y
KY bluegrass	Powdery mildew	Y
Bermudagrass	Leaf spot (Bipolaris)	Y
St. Augustinegrass	Gray leaf spot	Y
Perennial ryegrass	Gray leaf spot	Y

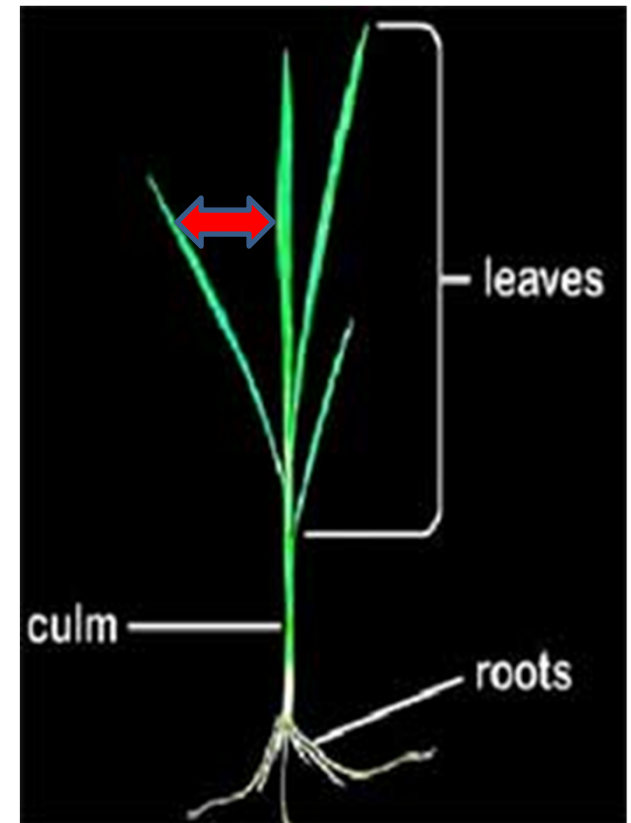
Leaf stiffness, wear and ball roll



Relationship between Si and leaf erectness in rice plants at flowering. (Yoshida et al., 1969)

Si supply (mg SiO ₂ L ⁻¹ as sodium silicate)		
0	→	40 → 200*
Leaf angle (between flowering stem and leaf tip)		
77		69 22

*Soil solution Si is usually around 3-17 mg Si L⁻¹



Ball Roll & Si?

Relative ball roll as measured via a modified stimpmeter. Numbers are the average of six rolls, with half in opposite directions. TifEagle putting green.

	May 25	June 1	June 4	June 7	June 11	June 18
	golf ball roll (inches)					
Si + N and K	55 a	59 a	56 a	66 a	46 a	53 a
N and K only	56 a	58 a	58 a	73 a	47 a	54 a
	June 22	June 25	June 28	July 5	July 10	
	golf ball roll (inches)					
Si + N and K	61 a	60 a	62 a	64 a	59 a	
N and K only	59 a	60 a	69 a	64 a	65 a	

Guertal, 2016

Turfgrass Wear & Si?

- Seashore paspalum - 'Sea Isle 2000'
- Si at 1.1 or 2.2 kg Si ha⁻¹
(1 or 2 lb Si acre⁻¹) –
- multiple applications



Silicon did not enhance wear tolerance or reduce injury of seashore paspalum.

Trenholm, Duncan, Carrow & Snyder, 2001

Sources

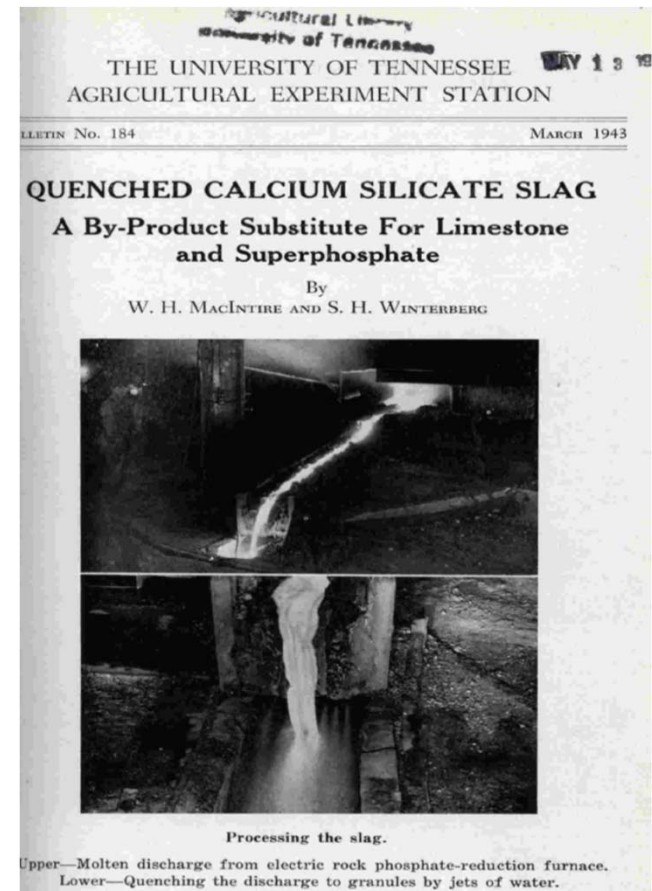
Calcium silicate slag -

From the reduction of phosphate rock with coke in electric arc furnaces.

Wollastonite – mineral widely used in industrial processes.

Potassium silicate -

From potassium silicate glass, produced in Furnaces by melting sand with potassium carbonate.



Rates

- Up to 10 metric tons calcium silicate slag ha^{-1} – 2000 kg Si ha^{-1} (1,780 lbs Si acre^{-1}).
- Typical recommended rate in turfgrass work? 11-18 lb Si 1,000 ft^{-2} .

THINK PRODUCT VERSUS NUTRIENT

So....Si?

- Little to no field evidence that Si helps with leaf stiffness, ball roll or improved wear tolerance.
- **Evidence for reductions with GLS, in several turfgrasses.**
- **BUT – variable with turfgrass species, disease and background soil Si levels.**
- Some evidence for improvements in salt or drought tolerance.
- Most work is with Ca Silicate slag – need work with other products.