Rice Nutritional Research in Florida

MABRY MCCRAY

UF | IFAS
UNIVERSITY of FLORIDA

Silicon

Silicon (Si) is a beneficial nutrient for rice production and rice absorbs Si in large amounts

Benefits of Si to rice include improved water use efficiency and increased photosynthetic activity, increased mechanical strength of cells and reduced lodging, and increased resistance to certain insects and diseases

Silicon

Grain yield of rice was determined to be increased when rice straw at harvest had Si concentration > 3% (Snyder, Jones, and Gascho, 1986)

As part of this research with silicon, Dr. George Snyder found that there were strong responses to calcium silicate when soil Si values were low

Dr. Lawrence Datnoff also determined that severity of brown spot and neck blast diseases in rice decreased significantly when adequate Si was supplied to the crop (Datnoff, Deren, and Snyder, 1997)

More recent unpublished research (2013) has determined that mill ash is not a good material for supplying Si to the crop

Silicon

Acetic Acid-Extractable Si (g/m^3)	Soil Test Category	Si Recommended (lb Si/acre)	Recommended Ca Silicate (tons/acre)
<6	Low	1340	3.5
6-24	Medium	1000	2.5
>24	High	0	0
Rice Straw Si (%)	**Si-Straw Category**	**Si Recommended (lb Si/acre)**	**Recommended Ca Silicate (tons/acre)**
<1.7	Low	1000	2.5
1.7-3.4	Medium	770	2.0
>3.4	High	0	0

Table from Korndorfer, Snyder, Ulloa, Powell, and Datnoff, 2001. The column for recommended Ca silicate is based on a 20% Si material. This table is not an official IFAS recommendation.

Calcium Silicate Recommendations for Sugarcane on Organic Soils

Acetic Acid-Extractable Si	Ca Silicate Recommendation
g/m^3	tons/acre
0-5	3.0
6-19	2.5
11-15	2.0
16-20	1.5
21-25	1.0
>25	0

Continuing Research with Calcium Silicate

Ca Silicate Rate	Rice Harvest 1	Rice Harvest 2	Total Rice Yield	Rice Harvest 1	Rice Harvest 2	Total Rice Yield
tons/acre	----------lb grain/acre----------					
	39-KL-36N			39-H-1NW		
0	5574a	2390a	7964b	5839a	2690a	8526a
1	6235a	2637a	8871a	5747a	2711a	8455a
2	5556a	2571a	8127ab	6318a	2753a	9071a
3	5669a	2640a	8309ab	6467a	2794a	9258a
P>F	0.0530	0.5472	0.0476	0.0564	0.8512	0.0594

Initial soil test Si for 39-KL-36N and 39-H-1NW were 27 and 16, respectively.

Iron

Dr. Victor Green, agronomist at the Everglades Experiment Station (now EREC), noted an incident of a rice crop on organic soil that germinated well but then the seedlings turned yellow and when the plants were 4-5 inches tall the leaves turned white (Green, 1956)

Treatments of ferrous sulfate were effective if applied prior to seeding (Green, 1956)

Dr. Snyder later studied this problem and noted that some areas in the EAA had this problem and some did not

He also noted that flooding favors reduction of Fe to the more available ferrous state, allowing for improved iron uptake (Snyder and Jones, 1988)

Iron

Dr. Snyder recommended 50-150 lb Fe sulfate/acre drilled with the seed at planting in soils with low available iron (Snyder and Elliott, 1994)

Foliar application of iron was not effective for post-emergence correction of rice seedling chlorosis (Snyder and Jones, 1991)

A soil test for Fe availability (concentrated HCl extract) was developed and Dr. Snyder suggested an economic cut-off soil-test value of 3.5 (Snyder and Elliott, 1994) (This soil Fe index value can be converted to g Fe/m^3 by multiplying by a dilution factor of 250)

Phosphorus and Potassium

Requirements of phosphorus (P) and potassium (K) are generally less for rice than other grain crops (Snyder and Jones, 1989)

Based on assumed crop nutrient needs, in 1981 threshold P and K soil-test levels of 4 (Pw) and 70 (acetic acid K) were suggested as threshold levels

Fertilizer P and K recommendations were made by the EREC Soils Lab from 1981 until 1985 and were discontinued because preliminary research did not support the assumptions on which the recommendations were based (Snyder and Jones, 1989)

Phosphorus and Potassium

Ten trials were conducted involving P and/or K fertilization of rice on organic soil from 1979 through 1987 (Snyder and Jones, 1989)

Pw values ranged from 2-15 in the trials, with six trials having Pw $\leq$ 5

Acetic acid-extractable K ranged from 26-193 with seven trials below 100 and two trials below 50

Of these trials, the ones conducted in 1986 also included the application of Ca silicate

Phosphorus and Potassium

There were no significant yield responses to P or K in any of the trials conducted by Snyder and Jones (1989)

Snyder and Jones (1989) discussed possible reasons for the lack of response including :

(1) an increase in P solubility with flooding,

(2) surface waters providing additional P and K to the crop, and

(3) fertilizer applied to rotation crops providing adequate nutrients for rice

Phosphorus and Potassium

We have conducted four additional rice trials (2013-2016) in which we have not found significant yield response to P or K fertilizer, although soil P and K values have not ranged as low as in trials conducted by Snyder and Jones

Acknowledgements

Support for rice nutrition research by the Florida Rice Growers

In-kind support by Florida Crystals Corporation