Bio-fortification of rice grain: A case study in Sarawak using calcium silicate and organic fertiliser

Maclin Dayod

Agri2015
13-15 July 2015
Doubletree by Hilton, Beijing, China
Interesting and Fun Facts on Rice

- A typical greeting in Bangladesh, China & Thailand – “Have you eaten your rice today?”
- Honda means “main rice field”
- Toyota means “bountiful rice field”
- Japanese word for cooked rice = meal
- In Japanese - Breakfast, lunch & dinner = asa gohan (morning rice), hiru gohan (afternoon rice) & ban gohan (evening rice)
- In Lao PDR & Thailand, eating rice = eating food
Is there a short-cut to increase yield and nutritional quality in rice?

- Breeding *IS* the way forward – *but it is time consuming*
- Many studies have reported the beneficial effects of CaSi on yield in rice – *but nutritional quality always overlooked*
- No comprehensive study in Sarawak yet.
Beneficial effects of silicon on plant growth in relation to biotic and abiotic stresses. *TRENDS in Plant Science*. 11(8)

Increase canopy photosynthesis

Increase stress resistance

Enhance resistance to biotic stress

- **Disease**
  - e.g. blast, powdery mildew
- **Pest**
  - e.g. stem borer, planthopper

Alleviate abiotic stress

- **Chemical stress**
  - Alleviate metal toxicity
    - e.g. Al, Cd, As, Mn, Fe
  - Improve nutrient imbalance
    - e.g. N excess, P deficiency
  - Alleviate salt stress
- **Physical stress**
  - Prevent lodging
  - Increase resistance to low/high temperature
  - Increase resistance to drought stress
  - Increase resistance to radiation stress

Alleviate abiotic stress

Si

Higher Yield

Higher Yield
Calcium: *both versatile nutrient and specific signal*

- participates in metabolic processes of other nutrients uptake
- promotes proper plant cell elongation
- strengthens cell wall structure
- participates in enzymatic and hormonal processes
- helps in protecting the plant against heat stress
- helps in protecting the plant against diseases
- affects fruit quality
- has a role in the regulation of stomata
- has a direct role in photosynthesis
Objective

- To compare impact of GML, CaSi and OF on grain yield and nutritional quality in rice.
Materials and Methods

• Variety Ukong was used a test plant
• Trial was laid down at Paya Paloh, Samarahan
• 4 treatments (1 t/ha GML, 1.36 t/ha CaSi, 1.76 t/ha CaSi and 2.16 t/ha organic fertiliser)
• 4 replicates arranged in RCBD
• Prices of the fertilisers:
  - GML = RM 0.36/kg
  - CaSi = RM 8.28/kg
  - Organic fertiliser = RM 2.64/kg
RESULTS

No difference in yield, no. of productive tillers & harvest index

BUT based on production cost, GML is superior
RESULTS

Too much CaSi can reduce Si and Ca accumulation in the grain

Si values in straw and grain, and Ca value in grain are consider low.
Implications of this work

• There is no such thing as “one size fits all”
  • Some varieties may not be responsive to certain fertilisers
• “Grain nutritional quality = yield” : do you prefer a plate-full of low quality rice or a quarter-full plate with rice pack with nutrition.
• Many factors affect grain yield and nutritional quality – soil, fertilisers, management practices
• Some rice varieties may be intrinsically have low ability to accumulate certain nutrients
• Screening for Si transporter in rice – future work
Thank you for your attention

“Have you eaten your rice today?”