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STATE UNIVERSITY

PROCEEDING

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Conference on Biosciences 2016

**“Advancing Biodiversity
for Sustainable Food Security”**

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Faculty of Mathematics and Natural Sciences Udayana University, Bali
Postgraduate Study Program of Biology Udayana University, Bali
North Dakota State University, USA
School of Biology, Udayana University, Bali

PROCEEDING

**THE INTERNATIONAL CONFERENCE ON BIOSCIENCES
"Advancing Biodiversity for Sustainable Food Security"**

Udayana University, Bali, 27th - 28nd July 2016

Held by:

**Postgraduate Study on Biology, Faculty of Mathematics and Natural
Sciences, Udayana University, Bali, Indonesia**

and

The North Dakota State University, United States of America

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PREFACE - CHAIRMAN OF THE ORGANIZING COMMITTEE

This proceeding compiles all papers presented in the International Conference on Biosciences 2016 held at the Udayana University, Bali on 27th - 28nd July 2016, which was aimed to gather scientists, government officers, and industries in Biosciences-related disciplines, so that they could discuss and share their expertise, experience and expand networking.

This International conference was an implementation of MoU between the Postgraduate Study on Biology and The North Dakota State University and held in accordance to the 54th Anniversary of Udayana University. The conference consisted of 5 plenary sessions in which all honorable invited speakers delivered their works covering general aspects of Biosciences related topics. They came from Australia, India, Indonesia, Japan, Malaysia, and USA. Besides these plenary sessions, we also had four satellite symposia, covering areas of: (1) Ecology and environmental biology, (2) Physiology and developmental biology, (3) Biotechnology, genetics, molecular biology, (4) Health and microbiology, and (5) Food and agriculture. Totally more than 100 contribution papers (oral and poster presentation) were presented in this conference. The efforts of the presenters to prepare their contribution papers for this conference are highly appreciated.

This Conference was financially supported by the Rector of Udayana University, Faculty of Mathematics and Science, Udayana University, Postgraduate Study on Biology, Udayana University, and NDSU through GIFSA Institute founded by Prof. Kalidas Shetty. Therefore, in this occasion, on behalf of the committee, I would like to thank their generous supports on this conference.

My special thanks should also go to all people who have been involved in the committee of the conference. Without their hard working and efforts, I am afraid we would not be able to make this event to happen.

We hope that all papers presented in this proceeding will prove useful for further studies in Biosciences-related areas.

Once again, thank you very much for your participation in this conference, and see you again in 2018.

Chairman of the Organizing Committee

Drs. Yan Ramona, M. App.Sc., Ph.D.

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Zn AND Fe MICRONUTRIENTS CONTENT IN RICE CULTIVAR GROWN AT JATILUWIH VILLAGE, TABANAN REGENCY, BALI

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Abstract

Rice as one of staple food in Indonesia has lots of cultivars. Each province has its own local cultivars. The study aimed to investigate the content of Zn and Fe micronutrient in some cultivars that have been grown at Jatiluwih Village as central of local rice production at Tabanan Regency. Micronutrient Zn and Fe are required for human metabolism especially for enzyme catalyst. Samples of rice cultivars ('Beras Merah', 'Cempaka Putih', 'Injin', 'Ketan Jaka', 'Ketan Tahun', 'Ketan Bali Merah') were collected from farmers at Jatiluwih ricefield. Rice samples were grounded, digested and analysed for Zn and Fe using ICP-E methods. Surprisingly, there were no Zn was detected for all rice samples. Content of Fe from the rice samples was detected and ranged between 0,06 – 0,25 mg.100g⁻¹. Deficiency of Zn and Fe micronutrients in human metabolism for some extend of time may influence human health.

Keywords: ICP-E method; deficiency; human health

BACKGROUND

Rice (*Oryza sativa* L.) as one of staple food in Indonesia has lots of cultivars. Each province has its own local cultivars. In Bali, there are some local cultivars that has been cultivated at Jatiluwih Village, Tabanan Regency as central rice production. The cultivars are 'Beras Merah', 'Cempaka Putih', 'Injin', 'Ketan Jaka', 'Ketan Tahun', 'Ketan Bali Merah'. Based on colour of the rice grain, 'Beras Merah' and 'Ketan Bali Merah' has red colour on the grain; 'Cempaka Putih', 'Ketan Jaka' and 'Ketan Tahun' has white grain; and 'Injin' has black grain coloured. In processing for food consumption, rice is grouped as rice for staple food ('Beras Merah', 'Cempaka Putih') and glutinous rice for snack or fermented rice or wine ('Ketan Jaka', 'Ketan Tahun', 'Ketan Bali Merah' and 'Injin'). These kinds of rice cultivars are cultivated in Jatiluwih for two growing seasons without any rotation with other plants such as Leguminoceae to improve soil fertility and to prevent pest and disease damaged. Each growing season required 6 months from planting to harvesting.

Staple food such as rice should provide complete nutrition for human health. So far, rice is source of carbohydrate and vitamin B for some cultivars. Nio (1992) showed that energy from red rice (353 cal) is higher than white rice (349 cal). Protein of red rice (8.2 g) and red rice (6.8 gr) due to thiamine content in red rice (0.31 mg)

higher than white rice (0.12 mg). USDA (2016) reported the composition of white rice for medium grain (per 100 g) as followed: calorie 360 kcal; protein 6.61 g; Zn 1.16 mg; Fe 4.36 mg. However, rice composition from Jatiluwih not yet published.

Micronutrients such as Zinc (Zn) and Iron (Fe) are also required for human nutrition, especially to support optimum growth and healthy minds. Zn nutrition for human is 15 mg per day. Zn deficiency caused potential risk in human health in many developing areas where staple food contains low micronutrient in the diet (Wang *et al.*, 2011). Micronutrients deficiencies already affect growth of children in developing countries including Indonesia. Symptoms of Zn deficiencies are retard growth and hair loss. Zn as catalizator is required to improve enzyme activation. Fe nutrition for woman is 18.9 mg per day and for man is 8.5 mg per day. Symptom of Fe deficiency is mostly anemia. In order to protect human from micronutrients deficiencies, at least the staple food can provide the nutrient completely and no more other supplement to consume daily. The study aimed to investigate the content of Zn and Fe micronutrient in some cultivars that have been grown at Jatiluwih Village as central of local rice production at Tabanan Regency

MATERIALS AND METHODS

Samples of rice cultivars (‘Beras Merah’, ‘Cempaka Putih’, ‘Injin’, ‘Ketan Jaka’, ‘Ketan Tahun’, ‘Ketan Bali Merah’) were collected from farmers at Jatiluwih ricefield. Rice samples were grounded and digested using HNO₃ and H₂SO₄ and analysed for Zn and Fe concentration using ICP-E 9000.

RESULTS

Zn concentration on rice

Based on Zn analysis using ICP-E, the result showed that there were no Zn was detected for all rice samples. There was no Zn in grain samples showed that Zn could not reach the grain due to some reasons.

Fe concentration on rice

Fe element could be detected using ICP-E. Content of Fe ranged between 0.06 – 0.25 mg.100g⁻¹ (Figure 1). Red rice (‘Beras Merah’) contain the highest Fe content compared to others rice samples. In contrast, glutinous rice (‘Ketan Jaka’) had the lowest Fe content. These two cultivars does not consume every day for people diet. Jatiluwih family usually consume ‘Cempaka Putih’ cultivars that only contain 0.08 mg.100g⁻¹ of iron.

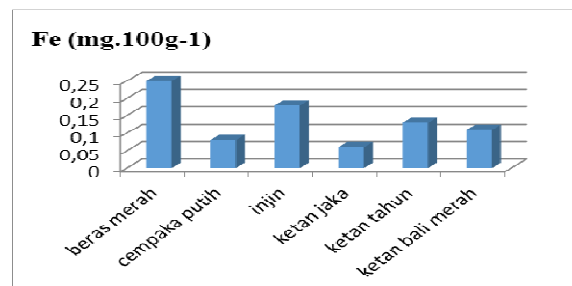


Figure 1. Fe content in Jatiluwih rice cultivars

DISCUSSIONS

No Zn on the grain might be caused by cultivar inefficiency of Zn transportation from soil solution to the grain or Zn was not available in the soil solution. Zn transportation from soil and its distribution to other plant organs including wheat grain offered better understanding to achieve the best ways to improve Zn content in the grain (Wang *et al.*, 2011). Solubilization and precipitation of Zn is influenced by pH and micro flora along rooting plant area. Tariq *et al.* (2007) found that Plant Growth Promoting Rhizobacteria (PGPR) activity assisted Zn absorption from soil solution and Zn mobilization to rice plant.

Concentration of Zn and iron in the xylem and phloem saps were available during growing season, and Zn concentration in the grain was 57 mg.kg^{-1} , and Fe concentration was 29 mg kg^{-1}). Zinc was transported from phloem through flag leaf. Iron also stored in the leaves and distributed to the grain using phloem transportation (Yoneyama *et al.*, 2010).

Zinc is vital for healthy growth. Dwarfism, stunted growth and being underweight for their age may occur in children if their diet is deficient in zinc. Deficiency of Zn and Fe micronutrients in human metabolism for some extend of time may influence human health. Deficiency of Zn and Fe micronutrients in human metabolism for some extend of time may influence human health.

CONCLUSIONS

Rice samples from Jatiluwih contain no Zn in the grain. Fe content is very low, between $0.06\text{-}0.25 \text{ mg.g}^{-1}$. These amount is very low for human daily intake.

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