Trial Focus

Photo 1. Control plot on the left and polyhalite-treated plot on the right, showing the plant height difference; Karawang, Indonesia. Photo by L.P. Yeo.

Optimizing Rice Fertilization with Polyhalite in Karawang, Indonesia

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Introduction

Indonesia's 2019 rice production is forecast to reach 37.4 million tonnes, which would represent 8% of rice production globally and make Indonesia the third largest rice producer in the world (USDA, 2019). Rice is important as both an export crop and, as a staple food in Indonesia, a critical crop for food security (Panuju *et al*., 2013). Milled rice consumption in Indonesia is around 127 kg per person per year. The Global Rice Science Partnership (GRiSP) forecasts that in 20 years' time Indonesia will require 38% more rice than today. To manage that, rice yields will need to significantly increase (GRiSP, 2013).

On a global scale, rice production and yields are increasing. One of the most important factors of this is optimized fertilizer use. Rice production accounted for 14.3% of the total applied fertilizers in agriculture during 2010-2011. In order to obtain high rice yields, fertilizer use must meet the nutrient requirements of the plant (Singh, 2017). In an effort to help Indonesia increase its rice yields through enhanced fertilization practices, this study

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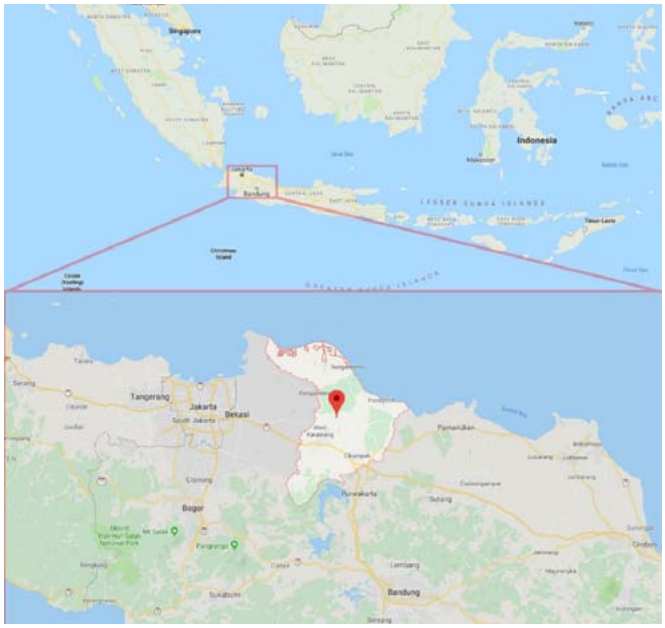

Fig. 1. Location of the polyhalite fertilizer study. The plot is marked with a red marker, and Karawang Regency in West Java province is outlined in red. *Source:* Google maps.

was conducted with the objective of evaluating the effects of polyhalite on paddy rice.

Materials and methods

The study was conducted in Karawang Regency, West Java province (Jawa Barat) in January 2018 (Fig. 1). Two varieties of paddy, Sertani and Kabir, were studied under polyhalite fertilizer treatment. Polyhalite is a natural mineral fertilizer containing four important plant nutrients: sulfur, magnesium, potassium and calcium (Tam Yermiahu *et al.*, 2017).

An unreplicated field trial was carried out on a 0.8 ha plot, with a control plot of the same size where the farmer's previous fertilizer regime was used. In the control plot, the farmer added 250 kg urea at transplanting and 500 kg NPK (15/15/15) at 10 and 30 days after transplanting. In the polyhalite-treated plots, 250 kg of urea was applied at transplanting and 150 kg of polyhalite was applied at 20 and 35 days after transplanting.

Results

Under the polyhalite treatment, the rice yield was 20% higher than for the control. Net weight (adjusted for the moisture content and thrashing) was 0.75 kg in the control and 0.90 kg in the polyhalite-treated plot. This translates to 7.5 and 9.0 t ha^{-1} for the control and polyhalite-treated plots, respectively.

Average rice yields of the Karawang area are 7.0-8.0 t ha^{-1}, so the yield results of both treatments are representative of the area. However, the polyhalite-treated paddy had bigger and stronger panicles compared to the control (Fig. 2). The grains were also rounder with a more uniform shape and better filling. Based on three samples containing 100 grains, the average weight of the grains was 9% higher in the plot treated with polyhalite (Fig. 3). In regards to the plant height, the polyhalite-treated rice was, on average, 8-10 cm higher than the control and appeared less affected by diseases (Photo 1, p. 15).

Fig. 2. Better grains filling and stronger panicle in polyhalite treated panicle compared to the control. Photo by L.P. Yeo.

Fig. 3. Weight of 100 grains in control and polyhalite treated rice. Note 9% higher grain weight in the polyhalite treated rice compared to the control. Photos by L.P. Yeo.

It was observed that plants in the polyhalite-treated plot were more resistant to lodging or damage caused by wind. Further, the farmer reported less blast disease (*Pyricularia oryzae*) and smut compared to the control plot. There was no identifiable difference between the two rice varieties Kabir and Sertani.

Discussion

The results from this field trial clearly demonstrate the effect of polyhalite and show that a combination of urea and polyhalite is more suitable than a combination of urea and NPK for paddy rice production. Polyhalite fertilization leads to a substantial yield increase, improved grain characteristics, and taller and healthier plants, indicating that it is a suitable fertilizer, containing essential rice nutrients.

But while this study shows a strong increase in yield and health of rice plants, it is not possible to evaluate the variability of the benefits obtained from polyhalite. The study was performed on a small scale with only three samples measured, making statistical analysis of the results unfeasible. More research on a larger scale needs to be carried out to further evaluate the reliability of this response, and to specifically test for additional benefits of polyhalite, such as increased disease resistance.

Conclusions

We conclude that a substantial 16% yield increase can be achieved by replacing NPK fertilizer with polyhalite in rice. Besides yield benefits, plants in the polyhalite-treated plot were taller, and appeared to be more resistance to disease, lodging and wind. Further research is needed to characterize the benefits and provide more detailed recommendations.

References

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Photo 2. Paddy producer (center) with the distributor (right) and an agronomist (left). Photo by L.P. Yeo.

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The report "Optimizing Rice Fertilization with Polyhalite in Karawang, Indonesia" also appears on the IPI website.