Rice Science FOR DECISION-MAKERS

Vol. 1. No. 2. November 2010

Biofertilizers may not be that good for rice

KEY POINT

- Biofertilizers are not effective in promoting the growth and increasing the yield of rice and corn.

Biofertilizers are being recommended in farming owing to the producers' claim that these fertilizers yield quality product without harming one's health and the environment. However, biofertilizers may not be effective as expected.

The study titled, *Comparative Performance of Biofertilizers under Aerobic and Anaerobic Conditions*, of Dr. Cezar P. Mamaril and Michelle B. Castillo revealed that biofertilizers are not effective alternate source of nutrients for rice plants in irrigated, rainfed, and upland ecosystems. Specifically, they found that biofertilizers are not effective in promoting growth and increasing the yield of irrigated rice, rainfed rice and corn, which are grown in irrigated and upland conditions.

Conducted in 26 field trials across the country, the study was implemented from November 2008 until March 2010. Study sites included Ilocos Norte, Isabela, Nueva Ecija, Laguna, Camarines Sur, Samar, Leyte, Negros Occidental, Agusan Bohol, and North Cotabato.

The rice plants in different ecosystems were subjected to nine treatments, including a control, in which no biofertilizers or commercial fertilizers were applied during the duration of the study. Treatments were arranged in Randomized Complete Block Design and replicated three times.

Effects of biofertilizers

The research studied the effects of biofertilizers recommended by the Department of Agriculture, which include Bio N, Vital N, and BioCon. To ensure the viability of the biofertilizers under study, they were obtained directly from the manufacturing site.

Results showed that rice plants treated with biofertilizers and half recommended rate of inorganic fertilizers yielded statistically the same with rice plants treated with half recommended rate of inorganic fertilizers alone.

Moreover, there were no significant effects observed in grain yield and yield components when compared with biofertilizers alone and with the control. Yield components measured in the study include plant height, tiller count, number of productive tillers, spikelet count, number of filled grains, number of unfilled grains, and weight of 100 grains.

The study also showed that biofertilizers did not increase the grain and straw yields of irrigated and rainfed rice (Fig. 1).

Likewise, the plant height, tiller count, number of productive tillers, spikelet count, number of filled grains, number of unfilled grains, and weight of 100 grains of rice plants applied with biofertilizers were similar with rice plants treated with half of the recommended rate of inorganic fertilizers.

On the other hand, the positive effects of biofertilizers on root length were not sustained (Fig. 2). There was positive effect observed during the seedling stage; however, the beneficial effect was not maintained when the seedlings were transplanted in the field.

Meanwhile, the response of corn to biofertilizer applications are similar to the trend obtained from irrigated rice trials (Fig.3). Based on the average yield, corn treated with full recommended rate of inorganic fertilizer registered the highest yield of 3.6 t/ha.

Recommended combination

Producers of biofertilizers assert that these alternate sources of plant nutrients encourage longer, stronger, and well-developed root system allowing greater soil exploration for better nutrient absorption. Moreover, biofertilizers are said to be made up of organisms that fix atmospheric nitrogen, which is said to facilitate the mineralization of soil organic matter and make nutrients available to plants. However, the results of this study counter these primary claims on biofertilizers.

Biofertilizers should not be recommended for rice production especially in flooded lowland as pure organic fertilizer will not be practical in attaining the full potential of rice.

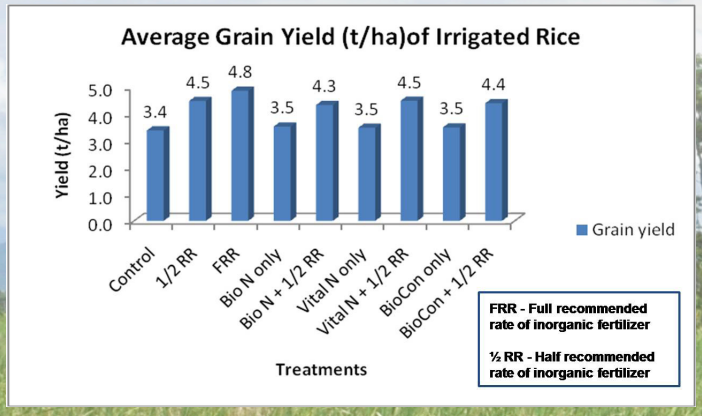

Fig. 1. Average grain yield of irrigated rice.

Treatments	Masaya, Laguna	Abuyog, Leyte	Abuyog, Leyte	Basilisa, Agusan	San Jor Sama
	DS 2008	*WS 2009*	*WS 2009*	*VWS 2009*	*WS 20*
	MS 6	NSIC Rc 150	NSIC Rc 154	NSIC Rc 160	PSB Rc
1. Control	5.7 b	5.6 b	4.5 c	7.7 c	4.73 b
2. Bio N only	6.4 ab	9.0 a	6.0 bc	10.5 b	7.78 a
3. Vital N only	7.0 ab	4.3 b	7.4 b	7.2 c	5.66 b
4. BioCon only	7.8 a	5.6 b	9.8 a	11.3 a	6.05 b

Results having any similar letters – not significantly different
Results having different letters – significantly different

Fig. 2. Root length (cm) before transplanting irrigated rice.

Rice straw enhances the activitites of indigenous soil microorganisms and hastens the decomposition of crop resdieus.

Application of other forms of organic fertilizers might be appropriate but should be in combination with chemical fertilizer. As supported by other studies, a ratio of 25 percent organic and 75 percent inorganic fertilizer produced comparable yield with pure inorganic fertilizer. The proportion was based on nitrogen content. However, a 50:50 ratio might still be acceptable depending on the Carbon: Nitrogen ratio of the organic fertilizer.

The need for stringency

Biofertilizers may have not yield positive result owing to the reduced viability of the products as transporting biofertilizers from the production site to the farm may have exposed the microorganisms to harsh conditions. Producers should be more stringent in prolonging the shelf-life and proper handling of the product.

Moreover, the proper application of organic and inorganic fertilizers should also be promoted to the farmers. Sustainable agriculture involves the use of organic fertilizers integrated or combined with the use of inorganic fertilizers while minimizing the use of pesticides.

CALL FOR ACTION

- Improve the viability of microorganisms packed in biofertilizers
- Promote the balanced use of organic and inorganic fertilizers to optimize rice and corn productivity

rge, ar	Batac, Ilocos Norte	Currimao, Ilocos Norte
09	*WS 2009*	*WS 2009*
: 18	**PSB Rc 82**	**PSB Rc 14**
	5.49 b	2.82 b
	5.69 b	8.45 a
	9.66 a	8.31 a
	5.53 b	8.28 a

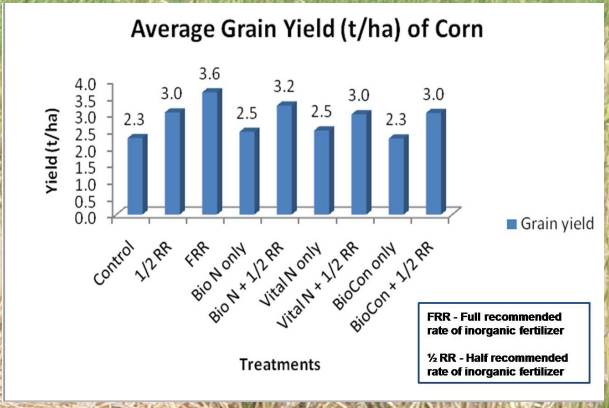

Fig. 3. Average grain yield of corn

Rice Science for Decision-Makers
November

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Facts and myths about fertilizers

Dr. Cezar P. Mamaril is senior consultant of PhilRice who served earlier as a professor at UP Los Baños and a scientist at International Rice Research Institute. Researching for more than 50 years, he had led the conduct of studies on soils and fertilizers in rice growing countries in East, South, and Southeast Asia such as Indonesia, Malaysia, Brunei Darussalam, and the Philippines.

As results of his studies on biofertilizers, Dr. Mamaril claimed that the term biofertilizer is a misnomer because these materials do not contribute nutrients per se but merely make nutrients available from other sources like atmospheric nitrogen or soil organic materials.

Basing on his researches published in national and international journals, Dr. Mamaril also demystified some myths about fertilizers:

Myth No. 1. Organic fertilizers can provide the amount of essential plant nutrients required by crops.
Inasmuch as organic fertilizers contain minimal amounts of nutrients, voluminous amounts of organic fertilizer are needed to provide enough essential nutrients for optimum yield, especially the macronutrients nitrogen, phosphorus, and potassium.

Myth No. 2. There are sufficient organic materials to replace inorganic fertilizers and meet the nutrient demand of crops in the Philippines.
If all the manures and-crop residues are applied in rice areas only, which total 4.2 million hectares, the amount of nitrogen, phosphorus, and potassium may be enough to produce only 5 tons of palay per hectare.
It may be impractical to apply such voluminous quantities, especially if the sources of organic materials are far from the farms. Some nutrients such as nitrogen may be lost through various biochemical processes while the manure is handled, transported, and applied to the soil. Thus, the actual amount used by the crop is less than what is said to be found in farm wastes.

Myth No. 3. Inorganic fertilizers make the soil acidic and cause a decline in soil productivity.
Chemical fertilizers, when applied in flooded soils, do not make the soil acidic. The results of a study conducted Dr. Felix Ponnamperuma, a retired soil scientist from IRRI, showed that the pH of flooded soils rises from acidic to neutral (pH7) reaction or from alkaline to neutral.
On the other hand, inorganic fertilizers per se do not deteriorate soils. The declining soil productivity is due to improper use of inorganic fertilizers that leads to imbalance of essential nutrients in the soil.

About the Material

Rice Science for Decision-Makers is published by the Department of Agriculture-Philippine Rice Research Institute (PhilRice). It synthesizes findings in rice science to help craft decisions relating to rice production and technology adoption and adaptation. It also provides recommendations that may offer policy triggers to relevant rice stakeholders in search of opportunities to share their knowledge on rice-related policies.

The articles featured here are grounded on solid basic and applied research in agronomy, biology, chemistry, and engineering; but it also underscores major contribution from the social sciences.

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