

# RESEARCH WITH IMPACT

## THE CHALLENGE:

It has become increasingly common for farmers to grow rice, followed by maize each year in their fields. This rice-maize cropping system provides an option for farmers to diversify and improve their income compared to growing only rice. Maize is popular because of its higher productivity and profitability, reduced water requirement, and greater resilience against poor weather and pest stress.

High-yielding maize removes more nutrients from the soil than rice or wheat. Current fertilization practices have led to an imbalanced and insufficient reservoir of many nutrients in the soil. Improper fertilization practices are leading to an overall decline in farm productivity. IPNI always recommends that farmers apply fertilizer nutrients according to the demand of the crop and apply nutrients in ways that minimize their loss and maximize their efficiency.

## THE RESEARCH SOLUTION:

A collaborative project was conducted between 2013 to 2016, in two districts of Bihar (Samastipur and Muzzafarpur) to measure the benefits of single and combined nutrients in a hybrid rice-maize rotation. Cooperating farmers conducted field trials, with treatments consisting of recommended application of nitrogen (N), phosphorus (P), potassium (K), sulfur (S), and zinc (Zn), and their respective omission plots. Crop yields of rice and maize were compared on the fertilized and unfertilized plots.



IPNI and University Scientists visit with a farmer at his field research site in Bihar, Eastern India.

## Enhancing Indian Farmer Income with Balanced Nutrition of a Rice-Maize Rotation

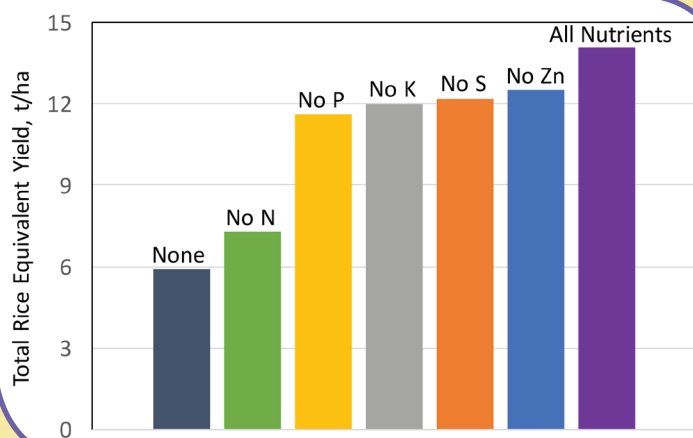
### THE RESULTS:

The participating farmers clearly saw that their yield and profitability were improved with proper nutrient management. When combining the relative yields of both rice and maize (called the rice equivalent yield, REY), production was highest with the fully fertilized treatment, where the crops received N, P, K, S, and Zn. Omission of any of these nutrients reduced the REY. The loss of yield (-48%) was greatest when N was omitted. Omission of the other nutrients also resulted in yield loss. The unfertilized control plot only had 42% of the yield that the fully fertilizer plots produced.

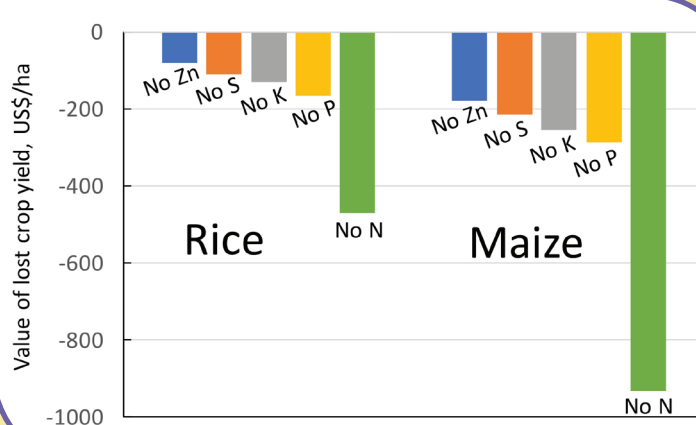
The yield boost from proper fertilization translated into greater farm income. Omitting the N application resulted in a loss of US\$470/ha of potential profit from the additional rice that could have been grown, and a loss of \$930 from the reduced yield of maize. Similarly, by

failing to add the other necessary nutrients, between \$80 to \$290 in potential profits were sacrificed. While N was shown to be the most important for increasing yields, the other nutrients also play an important role in sustaining high productivity.

In this study, farmers learned on their own fields the economic benefit of balanced fertilization for growing a rotation of rice and maize. They observed that balanced application of all the necessary nutrients results in maximum income. Field day programs were organized for farmers to share their findings with their neighbors. The importance of balanced nutrient management and the link between nutrients and yield were discussed through farmer training, field visits, and farmer-scientist interactions. IPNI is well positioned to organize our regional partners to conduct research, demonstrations, and outreach to promote improved nutrient stewardship.



Combined yield of rice and maize with full fertilization, compared with the omission of a single nutrient or all nutrients (control). Yields expressed as Rice Equivalent Yield, REY.



The loss of economic value of rice and maize caused by omitting a single plant nutrient, compared with the economic return from crops receiving all of the nutrients.



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