

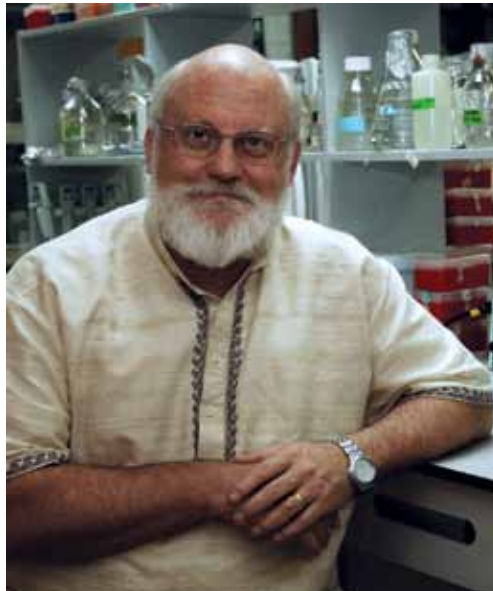
Meeting the Challenge of Expanded Rice Production

April 8—Dr. Robert Zeigler, Director of the International Rice Research Institute (IRRI), based in the Philippines, gave a presentation in Washington, D.C., Dec. 10, 2012, at the Center for Strategic and International Studies' (CSIS) Global Food Security event, titled, "Promoting Sustainable Rice Production To Meet Growing Challenges."

He addressed the current world food supply situation, and the prospects for scientific advance in agriculture. He called for dramatically increasing rice production.¹

The following are extensive excerpts from the first part of his presentation, on the history, scope, and importance of rice; next week's EIR will carry Dr. Zeigler's discussion of the scientific breakthroughs, which can contribute to transforming agriculture in the 21st Century. (Sub-heads are added.)

Zeigler was introduced by Kristin Wedding, Deputy Director and Fellow of the CSIS Food Security Project, who said, "He has run IRRI since 2005. Dr. Zeigler is a plant pathologist by training, and an expert on food security and poverty issues, especially as it relates to rice. He has an impressive career, working across Africa, Latin America, the United States, and Asia, and he's worked with the International Center for Tropical Agriculture at Kansas State University, and with the Generation Challenge program, which is part of the CGIAR system." He is a Fellow of the American Academy of the Advancement of Science. He serves on the Golden



Dr. Robert Zeigler

Rice Humanitarian Board.

We thank CSIS for their Dec. 10, 2012 event and [archive](#) of the audio and illustrations. The transcription was done by EIR.

Rice: More than Just Food

I think it's always useful for a group that's not intimately associated with rice, to just walk you through, for a couple seconds, what exactly is rice. Rice is probably the first domesticated crop in the world. It's incredibly diverse genetically. It was probably domesticated several times. So, it has a huge genetic reserve and resource, unlike many of our other crops.

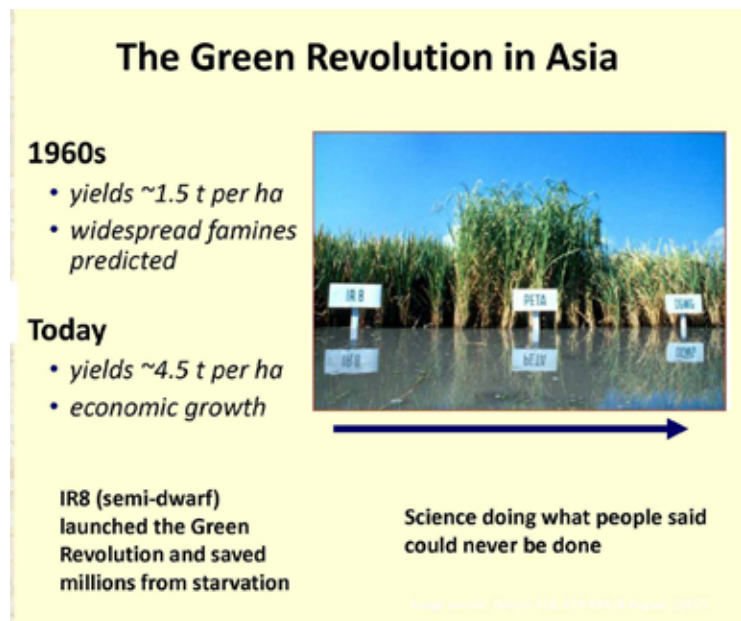
It's also the most important food for the world's poor—but it's also more than a food for much of human society, particularly in Asia. It really penetrates all aspects of life in rice-eating countries. Many cultural events, from birth, weddings, death, all have rice interwoven through them. So, if you're short of rice in half the world, it's much more of an existential crisis than just having to eat potatoes instead.

And also, very importantly, it grows under a monsoon environment. Rice is an Asian crop. Half the year in Asia, there's so much rain that no other crop can really survive, and so, in the great areas where rice is grown, for half the year, there's really no other alternative. So, I think that's something to keep in mind.

Now, I want to just also remind you of what the world was thinking in the 1950s and the 1960s. When I was in my formation at university, I was reading books like *Population Bomb*, *Famine 1975*, etc., and the prevailing wisdom was that the world was going to starve to death; Asia was a basket case—forget about South

1. See "Leading Crop Scientist Warns of Potential Rice Crisis," an interview with Dr. Zeigler, EIR, March 2, 2007.

FIGURE 1



Asia, Southeast Asia—there’s no hope. The future is in Sub-Saharan Africa.

Well, the Ford Foundation and Rockefeller Foundation had very deep roots in Asia. They felt that that was one vision of the future, but it didn’t have to be fact; that we could change the way things were going to develop. And they embarked on an aggressive program to invest in science to, in fact, change the calculus on food security for Asia. And they created the International Rice Research Institute in 1960, with the express purpose to change those predictions.

Basically, we had the mission then, which we have today, a very well-focused mission, to reduce poverty and hunger; improve the health and well-being of rice farmers and consumers; do that in a way that the technology that we create, and distribute this year, does not destroy the environmental base for production for future generations. And very, very importantly, recognize that the mission was so large, that we had to work with a rich array of partnerships, and that’s something that will be a theme that I hope permeates.

The Green Revolution

What came out of our work in rice was a Green Revolution in Asia, that most of you, I’m sure, have heard of. At that time, yields were very low, a ton and a half per hectare. When you added fertilizer to those rice varieties, they grew more leaves, grew taller, and fell over,

and your yields could actually be less. My predecessors—I happen to know the guys who actually did this—took and transformed the architecture of the rice plant, so that when you put fertilizer on it, it actually filled more grains, rather than just adding leaves.

Today’s yields in Asia are over four and a half tons per hectare. It’s really a phenomenal achievement (**Figure 1**). There’s the rice in the field; you can see there’s a two-meter tall or more rice plant which isn’t going to be able to hold up its grain. And basically, to me, that’s one of the many examples of science doing what people said couldn’t be done.

One of the things that bothers me most is when I look at projections for the future, I see they are almost all built on linear extrapolations from today. And an institution like mine, and other sister institutions—the very reason that we exist, is to change the curve.

The progression of increasing rice yields across Asia, primarily, and also Latin America—there was a breakthrough in the terms of a new plant architecture, new plant type, we call it, but there were many, many other advances that were made over the years, since the 1960s. A colleague of mine put this together (**Figure 2**):

The line shows a steady growth in world rice yields. Below the line are a number of advances in plant biology; above the line a number of advances that were made in the way we manage the crop. Because you have to address both issues. You can produce a genetically superior crop, but if it’s poorly managed, it won’t express its potential. You could provide the best management practices to a crop which has little genetic potential, and you won’t realize the yield. So, it’s a yin and yang sort of relationship.

Now, just a word, some hard numbers, on economic impact. The Australian Center for International Agricultural Research, ACR, has been funding IRRI for quite a number of years, and the ministers started to ask questions about, what’s the return on the investment? And so they contracted an economic analysis of Indonesia, Philippines, and Vietnam, and asked the question: What has been the economic return on IRRI’s investment in rice breeding for these three countries? That’s only IRRI, that’s only rice-breeding, and they calculated that the return for those three small countries, was \$1.46 billion *per year*, every

year, from 1985 to 2009 [emphasis added].

\$1.46 billion is more than has been spent on IRRI for its entire existence. So, it's an unbelievable, unbelievable impact.

A Global Staple

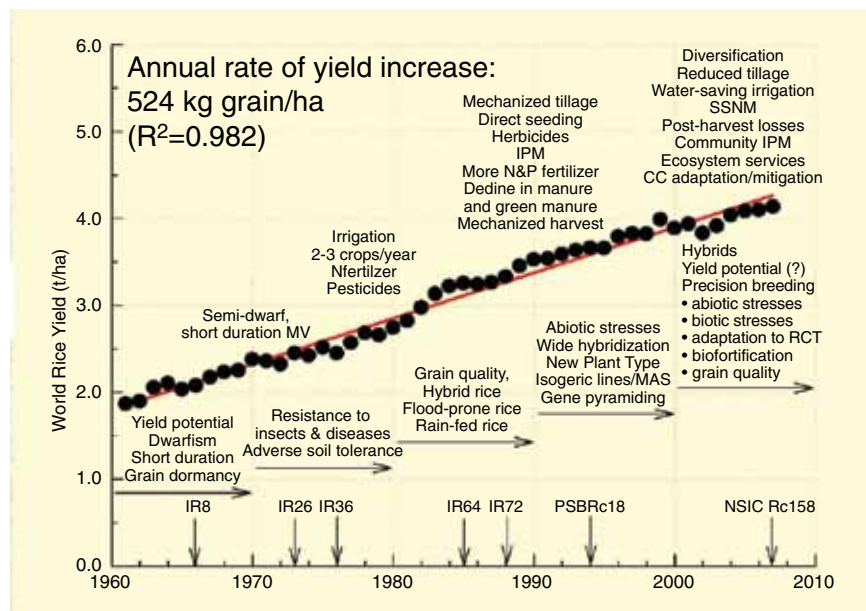
Rice is, in fact, a global staple. It is the primary food for more than two-thirds of the world's population. Half the world's population derives a very significant portion of their caloric supply from it. It's the fastest growing food in Sub-Saharan Africa, particularly very well suited for urban populations, and for Africa, improving rice supplies is essential, given how much they import. It's also very important in Latin America, particularly, again, in urban areas.

So, rice is, and will continue to be, a global staple.

Now, if we look at the rice consumption levels (**Figure 3**), the very dark areas are countries where rice consumption exceeds 100 kg per person per year; obviously, very high levels of consumption across Asia, but important levels in Sub-Saharan Africa, as well. When you overlay the distribution of poverty on that, where each of those dots represents a quarter of a million people living on less than \$1.25 a day, you can see that where there's a concentration of poverty, also there's a very large consumption of rice. And basically the equation is: If you want to do something about poverty, doing something about cost of rice, rice supplies, is going to be part of any equation.

Put in other words: Poor people may spend 50% or more of their income on food; and so any increase in the price of rice, if their primary staple is rice, is like a cut in pay. Conversely, when prices

FIGURE 2

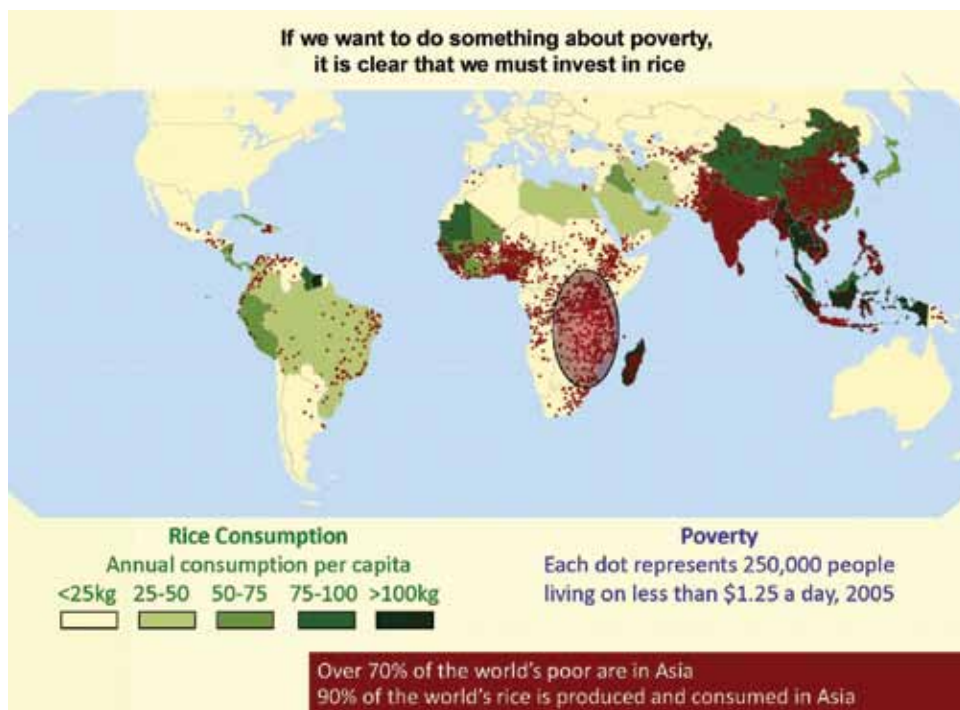


Courtesy of Robert S. Zeigler

are low, it's like providing more disposable income.

Every time I see those red dots of a quarter million people, I try to put a human face on what poverty is. And I took this picture [see photo] up in northwestern Bangladesh a number of years ago, and I was driving through

FIGURE 3



Courtesy of Robert S. Zeigler

the countryside, and this was obviously after a rice harvest, and there were all these piles of dirt out in the field, so I asked my colleague, what were those piles of dirt? And he said, come on out and have a look. I think you'll find it pretty interesting.

And so, if you look closely at this, you'll see a little tube down there. And what he explained was going on, was that after a rice harvest, the very poor people would go out into the field and look for rats' nests, and dig up the rats' nests, and steal the rice from the rats. So, that's a level of poverty that, to me, is almost unimaginable, that you end up stealing from rats.

And of course, the real issue of poverty is not just not having enough money—it's the consequences of poverty, such as malnutrition. That is something that we need to pay very close attention to. Think back to the rice price spikes in 2008, where prices just shot through the roof, and rice became unaffordable in large parts of the world for a significant period of time. Even today, rice prices are 70% higher than they were just a few years ago. All of that translates into people not having enough money to spend on food. And for a child who's under the age of 3 to be malnourished, can have very serious consequences for the rest of his or her life. And so I think we need to keep that in mind.

And when we talk about rice, let's also keep in mind that it's grown by, typically, very, very small farms. Today, much of the labor that goes into rice production is by women and children. It's still very labor-intensive. And I think the way the world is going, we're going to see a very great transformation in the way rice is grown over the next couple of decades, as people, economies, evolve, and people really don't want to do the back-breaking labor that they have in the past.



Courtesy of Robert S. Zeigler

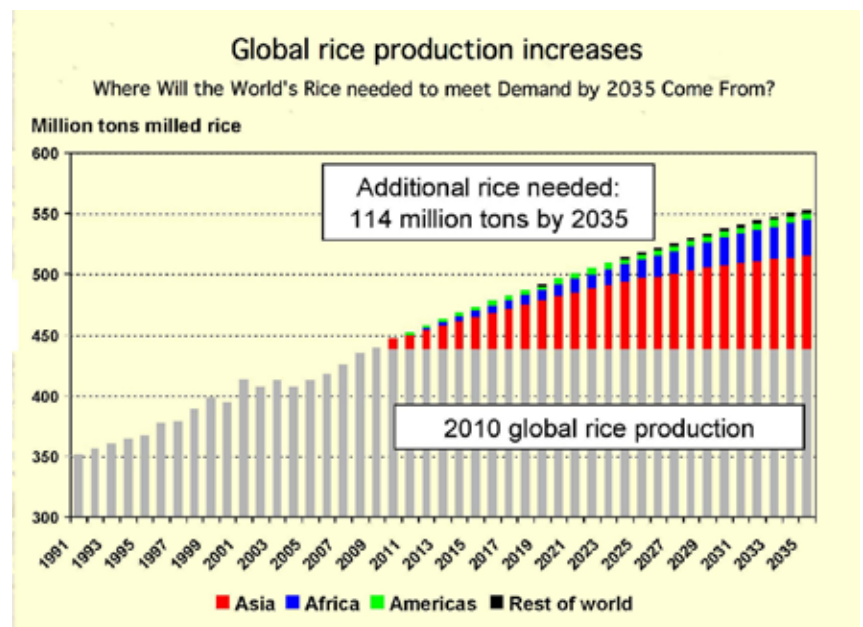
In Bangladesh, the poor are reduced to raiding rats' nests for the rice they can glean from them, as seen in this photo.

When we look at rice demand, all of our projections have been very conservative. We are looking at a continued growth in rice demand, an additional 114 million tons, or 25% increase, just by the year 2035 (**Figure 4**). And most of that growth will be in Asia, which is the red bars, but with continuing demand in Sub-Saharan Africa. So, for the foreseeable future, global rice supplies are going to have to continue to grow.

Where Will More Rice Come From?

Now the question is, where is that rice to come from? Ideally, if we don't want to clear pristine lands for further agricultural growth, it's going to have to come from existing rice lands. But in Asia, in particular, where 90% of the world's rice is grown, land is moving out of rice. You go to areas around Manila, or Bangkok, or Ho Chi Minh City, Hanoi, or Dhaka, very good prime rice land is being converted into non-agricultural uses. Labor is moving out of rice, and there's increasing competition for water.

FIGURE 4



Courtesy of Robert S. Zeigler

So, we've got a major challenge. We're going to have to increase the productivity of our existing lands just to stay where we are, let alone improve our productivity. So, we have some major challenges facing us. And it may be, that more rice lands will have to be opened up, particularly in Sub-Saharan Africa, but that's a much longer term prospect that is not going to solve any problems over the next decade, that's for sure.

Now, if we consider climate change, global temperatures are increasing; that's a fact. It's also a fact, that rainfall patterns are changing, and we've seen that very spectacularly this year in North America. It's a fact that sea levels are rising. And there certainly seems to be a trend of more severe storms, particularly in tropical areas.

So, given that we've got to increase productivity on existing lands, and that we have all these challenges facing us, it is, I think, a situation more daunting than faced by predecessors in the 1960s. And if we consider climate change, that's a reality.

And work that's come out of our institute that's really sort of mind-numbing, or mind-blowing—and this completely caught the world by surprise—we did a long-term analysis; we have a set of long-term experiments, that have been running three seasons a year since 1963, and they continue. And it turns out that there was a tremendous database on yields, and temperature records. And we found a relationship between nighttime temperatures and yield. And for every one degree increase in nighttime temperature—not daytime temperatures, but nighttime temperatures—yields dropped by 10%. That's an *enormous* hit. In fact, it was so large that nobody believed it. But it has since been repeated in very carefully controlled studies in wheat, and other field studies, around the world. So, that's a pretty shocking figure.

Note: The final part of Dr. Zeigler's presentation, on developing rice varieties that will be able to deal with changing climate, will be in next week's EIR.

Discussion

Michael Billington (EIR): I wondered if you could address the big picture, just briefly. When you were here five years ago, you warned that we were facing a very, very severe global food disaster, if things weren't changed. And obviously, they weren't changed.

In the meantime, we've had this global financial

breakdown, and all you hear is, austerity, austerity, austerity. There are alternatives. There's discussion of a Glass-Steagall/Roosevelt approach to the debt, so that we can start generating credits for big infrastructure. It's a fight. Could you give us a sense of your vision on this?

Zeigler: Well, yes—it's precarious, because in some areas, like South Asia, which is a real pressure point, there's a very deep awareness that investments have to be made. The political structure is so paralyzed, that I'm not as optimistic as I would like to be.

China, in my opinion, is very concerned, and they are actively seeking to source rice supplies elsewhere, which means it is a warning sign. And I would say that we're going from season to season, year to year. Two successive completely failed monsoons in India would be catastrophic. We had a delayed monsoon last year, but they had built up their strategic reserves, and so they were able to meet the demand.

I think you need to have policies in place that will allow grain to be traded. Now, this is a very touchy question. I don't pretend to know the answer, because you can come down on either side. A country, if it's facing a population that's starving, politically has no choice but to stop exports. It's just the way it's going to be.

But then, when that happens, you have exactly what happened in 2007, when it was a set of dominos. Vietnam stopped its exports in July because of food inflation and huge shortages. India blocked its exports because of a cyclone that hit Bangladesh, and they knew that Bangladesh was going to be demanding rice from them. Philippines then, in a panic, went out and issued a tender for 2 million tons, and all hell broke loose. And it was a very difficult situation.

And that wasn't even a bad weather year. That was a political panic. If you have a bad weather situation, which, I don't think is avoidable—we will eventually have it. And we had it this year, and look what happened to maize and soybean prices. We're extremely vulnerable to weather shocks. And the best, I think, we can hope for, is that our policymakers wake up a little bit about their response, and try to put some forward thinking in place.

Could there be triggers where there would be a temporary suspension of the requirement to use X-amount of harvest in ethanol? Could there be a lifting of the WTO rules on grain prices and trades, and things like

that? I don't know—you need some people with political courage to make those decisions.

Not Enough Investment in R&D

Keith Fuglie, USDA Economic Research Service: Last Friday [Dec. 7, 2012], the President's Council of Advisors on Science and Technology released a report that said that, in the United States, we're not making sufficient R&D investment to meet the challenges facing this country. And my question is, what are the implications of something like that, for a place like IRRI? You talked about the importance of science partnerships, and so forth. So, if countries like the United States don't make the investments in agricultural science, what are the implications for a place like IRRI?

But I also want to relate it to the fact that, in places like China and Brazil, we see a big expansion of research capacity, so is that going to be sufficient to, say, offset the kinds of scientific advances that an institution like yours has relied on from the United States in the past?

Zeigler: No. It's very troubling, what's happening in the U.S. and Western Europe. It's troubling for a couple of reasons. One, you're probably familiar with the work

of Phil Pardey and his colleagues. Well, they were able to demonstrate that the drop in public-sector investments in ag research wasn't felt until about 15 years later, in terms of total factors of productivity decline. So, as the pipeline shrinks—cuts that are made this year—the effects aren't felt for a decade or more, and so, there's no short-term incentive for the politicians.

So for us, it's very bad, because we depend upon what's coming out of the U.S. university and public research arena. What's coming out of the private sector is very difficult for us to get access to. The investments by China and, to a certain extent, Brazil, while large, they don't like to share as much as others. And a lot of that work is not as accessible, not for language reasons only, but some of it is just not—it's held more strategically—and a lot of the effort is towards developing relationships in developing countries.

For example, the hybrid rice goes from China out to other countries. The parental lines aren't shared; only the seed is shared. So the technology, the core technology, is held at home.

So, although I'm always happy to see more investment in ag R&D, the key is for it to be available. That's my concern.

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