

Interview with Robert Zeigler, Director General of the International Rice Research Institute (IRRI)

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IRRI's future priorities

InfoResources: What are the key points of IRRI's new strategic plan?

Robert Zeigler: One point to keep in mind is that IRRI has been in existence since 1960, and 10–12 years ago was the last time that IRRI took a serious look at what it was doing and why it was doing it. Since then – if you think back to the mid 1990ies – things have changed. There has been a huge revolution in biology, revolutions in genomics, biochemistry and molecular genetics, in communications and computational power. In our laptops we probably have the computational power that the entire world had 25 years ago. In the light of this huge change we thought it was very important for IRRI to take a close look at what it was doing.

Another change – not a technical but a social change – has been that the world development community has looked closely at how it approaches development, has set up the Millennium Development Goals, and really has very much of a goal-oriented approach towards development. This means looking and asking: What do we want the world to look like, and what will it take to get there? As an institution we thought that this was a very powerful approach to setting up a research agenda. And so we went through our strategic process and adopted, first of all, a very consultative approach where we brought in stakeholders and sought their specific guidance as to what they thought was needed, what they thought IRRI's role should be, and what they thought the role of other people should be. We also brought in external experts, asking them the same questions. Naturally, we consulted quite a bit internally; we even had farmer consultations in order to get a perspective at the farm level as well as the level of the most advanced research laboratory. Eventually, we were able to boil down the outcomes of this process to five strategic goals for our institution:

- The first is to address the poverty alleviation in areas where poverty is endemic and rice is a main source of livelihood or principal food.
- The second is to assure the sustainability of rice production systems and that the environment, upon which we depend for the world's future food supplies, is maintained in a healthy condition.
- The third strategic goal is to improve human health and nutrition, particularly for rice consumers and rice farmers.
- The fourth strategic goal is to harness the capacity of information and communications technology and make the knowledge that has been developing at an explosive rate over the past decades available to all people.
- The fifth goal is to make sure that the science that will be needed tomorrow will have the necessary tools and knowledge around rice germplasm: a science for tomorrow, but based on what we do today.

The shift in thinking that has taken place is that for quite some time, IRRI has been focusing primarily on food security, whereas this strategic plan changes our focus more towards poverty and human aspects. This does not change much in terms of the expertise that is required, but it does impact on where we work and the kind of work we do. For example, if we were interested only in rice output, we would focus on the intensive, highly productive, irrigated systems. If we were interested just in producing enough food for the world, that would be our focus. Of course this still

remains important, don't get me wrong. But if you want to address poverty issues, the equation changes. The very large rice-producing areas of South Asia, the greater Mekong region and sub-Saharan Africa where rice is grown under rainfed conditions and yields are very low: this is where the poorest people live. If we are going to focus on poverty, we have to invest relatively more resources in these rainfed areas. And if we look at the challenges facing farmers who grow rice in rainfed areas, they are very different from the research challenges facing farmers who grow rice in intensive production systems. These differences change the focus of the work we do. Nevertheless we are continuing to work on our "bread and butter", so to speak – our heartland research on rice improvement, understanding the rice plant, understanding how to improve the rice plant more effectively, understanding how rice grows best in different environments. Simply from now on we will be asking these questions more and more within the context of unfavourable rainfed environments.

InfoResources: Does this also imply a change in the way you work? For example, will you work with different partners or collaborate more closely with the farmers?

Robert Zeigler: Yes. IRRI has been working closely with partners for many years. We have partnership as a model for our research, including collaboration with farmers. We are one of the pioneering institutes with regard to participatory work with farmers, particularly in Asia (farmer field schools, etc.). So this is certainly something that will remain part of our activities. The change is that we will be focusing more on problems and issues that are characteristic of rainfed environments – for example drought tolerance in rice, as well as tolerance of flooding and submergence, which are common in these areas that are typically flood-prone. Seawater encroachment can cause problems related to salinity. These problems will receive more attention. Of course the nature of our partnerships will shift; I think we will be collaborating more with institutions that are located in these rainfed environments. Certainly these changes speak for our launching a programme in sub-Saharan Africa. IRRI did not have much of a programme in sub-Saharan Africa in the past. If we are going to be looking at poverty in rainfed rice-production areas, sub-Saharan Africa is clearly very important. Our shift in perspectives also argues for an even stronger partnership with advanced research institutions. If we look at the problems of drought tolerance, submergence tolerance and salinity tolerance, developing that in a rice plant is not a trivial undertaking. It requires some very fundamental research. For example, a publication has just come out – in the "Nature" journal, I believe – about IRRI's work on submergence tolerance, which was done in a partnership between the University of California in Davis, the U.S. Department of Agriculture, and IRRI, and which required some very sophisticated genetic work allowing us to identify the genes involved in submergence tolerance and then transfer them into a traditional variety. This was a situation where very basic research allowed us to accelerate our work and, together with our national programme partners in India, create a product that is directly suitable for the poorest of the poor farmers in rainfed systems.

InfoResources: Let us talk some more about the elements in this strategy that are new compared to older strategies. You said that this shift in focus from food security to poverty is one important change of direction. Are there any other changes?

Robert Zeigler: Yes, certainly – the whole area of communications and knowledge management. We have seen the explosion of information in all of our lives, and agriculture is affected by that explosion as well. We have a huge volume of information generated around rice. Rice has been a model system for basic research on genetics, the genome of the rice plant was the first crop genome to be sequenced, shortly after the human genome. This special role of rice in research continues to generate a particularly huge volume of data and information that has to be managed, understood, and used. A similar explosion in the quantity of information is taking place with regard to how the crop is grown, as well as climate data that relate to agriculture. The question is: How do we manage this information, and how do we make it accessible? This is why one of our strategic goals is this whole issue of equitable access to information in a usable form. We are looking at coming together with advanced institutes around the world, with national systems who generate these data, and with the private sector, and reaching an agreement on how we can collate or accumulate or collect all information related to rice and make it accessible to people in a way that they can understand it, in a way that they can use it anytime and from anywhere.

Cell phones are now cropping up in the most unusual places. Ten or fifteen years ago, I remember people talking about how Africa would never be able to develop – if for no other reason, because they were not able to redevelop their telephone system that was lost during the seventies and eighties. Well, they did not redevelop their telephone system; they are inventing a new one, the cell phone system. And so, what was thought to be impossible in Africa a decade ago is now coming. Even in remote places you will find cell phones. I do not have any doubt that ten years from now, handheld technology allowing an individual farmer or a researcher anywhere to connect to the internet will be a reality. You may think that I am nuts, but I am willing to put money on the table that I am right.

InfoResources: But access to information will have a price. If you want to make a call, you will have to pay. This will create another gap.

Robert Zeigler: Right, but the possibility is there. And I am saying that the phones are already there. The network is being put into place. The technical possibility is there, and the rest is a question of political will. But more importantly, the information as it is structured today is of no use to anybody. We must find a way to organise that information so that people can access it and use it. There are certainly unresolved questions with regard to direct access, there is the problem of language, and there are more problems regarding the process of preparing that information in a way that people can understand and find it. Ownership is extremely important as well, that is why in our goal we speak of "equitable access". We need to move to an environment where access is given and where the value added comes not from the information itself but from what you do with it. IRRI has moved towards an open source philosophy in how we handle all our information. We believe that everything that IRRI does must be accessible to the world community. So this is another major change in our thinking.

Another change in emphasis in our approach is related to our poverty focus: we are putting more emphasis on the nutritional value of rice. Certainly a fantastic breakthrough was made here at ETH with the Golden Rice by Ingo Potrykus and his colleagues at Freiburg University. This is really something that IRRI is very much participating in. We believe that many of the consequences of poverty, such as malnutrition, vitamin A deficiency, blindness, and maternal anaemia, can be alleviated in part by improving the nutritional value of a crop like rice. Many people who are very poor eat almost nothing but rice. They may spend 70 percent of their budget on rice alone. If that is what they spend just for rice, you can be sure they are not getting many fruits and vegetables at all, let alone proteins. So if we can improve the nutritional value of rice by increasing its contents of provitamin A, iron and zinc, we can make a major contribution towards alleviating one of the consequences of poverty. We do not believe that provitamin A rich rice or high-iron or high-zinc rice is the only solution to nutritional problems, but it would be a significant contribution.

InfoResources: So you have shifted your point of view. Up to now you have been focusing mainly on rice, whereas now you are putting the human being in the centre.

Robert Zeigler: Right. Exactly. I think the cover of our new [strategic plan](#) represents that. The cover of our last strategic plan had a rice plant on it.

How can IRRI reach its goals?

InfoResources: IRRI has set itself huge goals that require a lot of work. How do you think you can reach those goals?

Robert Zeigler: The main trick is defining very clear targets and objectives within each goal. Where are we going to reduce poverty? How are we going to do it? What would the particular interventions be and where do we expect them to work? We break down each goal into several targets, set objectives for each of these targets, and define the concrete activities necessary to reach these objectives, along with the resources needed to conduct them. It would be hopelessly naïve to think that we can alleviate poverty by ourselves. But we can ask: Where can we make a difference? And, once this question is answered: What do we need to do to make that particular difference in that particular place? What does that cost, and how do we approach the task? That is the process we

have gone through for each of our goals, translating them into a much more detailed three-year medium-term plan that defines the specific activities we are going to undertake over the next three years. And now, of course, we are selecting these targets and activities based on what we can do, what falls within our overall mandate, and what we believe we would be able to do if we could expand. We ask ourselves this because we do not just want to say it is going to be business as usual, this is what we can do, therefore this is all we want to do.

And then, most importantly: What strategic partnerships are required in order to carry out a particular activity? This is the main message: We do not consider ourselves to be the only player in rice research. When IRRI was founded, it was essentially the only player in the field of rice research in the tropics. Over the years this has changed, and to a large extent it has changed because of IRRI's success. We have trained thousands of scientists to work on rice, and they are now our collaborators and partners around the world. Moreover, as I have mentioned earlier, rice has become a model system for genomics research. Therefore, there is a whole set of advanced research institutions around the world who have incredible expertise on a very small part of rice and are very useful for us to work with. We find ourselves in an interesting role of legitimate players in rice research – that is, we conduct research that is of relevance from the advanced, cutting-edge level all the way down to the farm level. We have our own research agenda, but we also have the ability, the credibility and the desire to work with partners around the world in order to assemble the teams required to address what you rightly described very, very broad and challenging goals. I think that is the key. And fortunately – I don't want to sound immodest, but IRRI still has the credibility as an institution of excellence in science that allows us to bring together the best minds and say: Ok, let's focus on these problems.

InfoResources: Do you also see a potential in working with private companies?

Robert Zeigler: Yes, I see a potential in working with the private sector, certainly in the area of seed-based technologies. The private sector has made a lot of progress in translating advances in molecular biology into products that are useful in the farmers' fields. Obviously, this is quite a controversial area in Switzerland and in some other countries, but the fact is, it happened. Now the challenge is – and I am not sure if we will be able to actually meet this challenge – for the private sector to make information related to their discoveries available to institutions like IRRI, so that we can modify them in a way that will be useful in developing countries. The humanitarian licenses around Golden Rice are very promising. A number of companies have said: Yes, we believe that this is an important product that can make a difference in the lives of hundreds of millions of children, so we are willing to make our technology freely available. We have been discussing with several companies about whether they could make the information concerning some of their discoveries, for example with regard to drought tolerance, available to us. We can work out certain agreements with these companies that allow us to develop products that are relevant to poor farmers and poor consumers, without threatening the companies' legitimate business interests. That is what we are in the process of trying. I do not know whether we will actually succeed. A lot of people talk about it, but it is challenging to actually do. Nevertheless, I think we should work hard at it.

There are other models of cooperation with the private sector. Cooperation might be much easier to achieve in the field of information management. It is conceivable that some of the large multinationals in information management might be very interested in working with IRRI to make information available to farmers, if there was a mechanism to let them see that this would give them a market for some of their other technologies. Creating something of value to small farmers around the world might be very interesting in a business model, so it could be a win-win situation. There are many different modes of collaboration with the private sector that you can think of. I do not know which of those will work. My best guess is: something we have not yet thought about would probably work best. Not to dodge the bullet, but this is certainly a challenge.

InfoResources: Last week the governing body of the FAO treaty reached an agreement: 1.1% of the revenues made with products based on genetic resources of developing countries shall be used for poverty alleviation activities. Would that be a possibility for IRRI to receive new funds?

Robert Zeigler: I do not want to be mercenary about that. When we look at benefit sharing: If people believe that the research done at IRRI directly benefits people who use the germplasm, then IRRI

would be a legitimate way to share that benefit, because we distribute the benefit across the world without any political considerations, without any consideration of national borders. So yes, I think that is a possibility but I don't want to hazardously guess at when that might become reality. I am not sure exactly how many resources will actually flow into the benefit sharing pool.

InfoResources: But it is really interesting.

Robert Zeigler: It is. Yes, the whole concept is intriguing: If you derive profit from exchange of germplasm then basically you should return something. This is not an unreasonable position at all.

InfoResources: However, the question is, who is the owner of the resource and how does the remuneration reach the people concerned?

Robert Zeigler: Yes, the devil is in the details.

InfoResources: What about collaboration with other CG centres?

Robert Zeigler: We have a very significant collaboration with CIMMYT, a joint programme on information management. In Africa we will be working much more closely with WARDA, and we are sharing facilities with IITA in our Tanzania office. I would think that as we look at issues related to climate change, we could form partnerships with several different CG centres, all the way from the Food Policy Research Institute in Washington to CIAT, who has outstanding Geographical Information Systems. We do not need to reinvent that sort of thing, we can take advantage of what exists. So indeed there is a trend within CGIAR for centres to collaborate much more closely. The idea of competition between the centres has been too prominent in the past and I have no interest in pursuing that. I have worked at CIAT, I have worked at CIMMYT, I have worked here, I have had collaborations with other institutions. I think where we can develop a common research agenda we should work together.

InfoResources: This is nice. Before it was different. There was a kind of "war" over who gets the money.

Robert Zeigler: Well, we still have worries about money, but I think what we need to do is ask ourselves whether we are going to fight about this tiny bit or whether we are going to find ways to actually create an agenda that is more attractive and attract more money. That is a much more positive approach.

Rice farming today – Main Challenges

InfoResources: Moving from the institutional aspects more to the thematic issues, to rice farming – could you say something about the main challenges for rice research today from the ecological, the economic and the social point of view?

Robert Zeigler: I think the ecological, the economic and the social aspects actually integrate. They may be separate axes but when you look at the issue, they actually all contribute to what I think a meaningful agenda should be.

InfoResources: They are part of the concept of sustainability.

Robert Zeigler: Right, exactly. Sustainability has economic components and it has social components. The farmer is the person who has to survive and make a living, and that can be determined by economic and other social forces as well as climatic forces and, in turn, has an impact on the environment – so it does sort of come together. But I do not want to avoid your question, so having said that as a qualifier I can go a little more into detail. Certainly, from the perspective of the environment, the sustainability of intensive systems is

of paramount importance. The human species depends upon intensive rice systems for about half of its food. We cannot allow these systems to deteriorate. So we have to look very closely at what is happening with them. These systems have been producing rice continuously for thousands of years. Now the question is: What are some of the forces that are driving changes in these systems? There are the shifts in water availability – almost two thirds of the fresh water that is withdrawn for human use in Asia goes into rice production. And that water is becoming less available because of competing urban centres, competing industries, I would even say golf courses – they require a lot of water –, and fish production. All of these are legitimate enterprises, but they do impact on the agricultural sector. In the case of rice it is particularly intriguing, because there are forces that are driving the intensive systems to shift from continuously flooded to flooded during the rainy season combined with an upland crop during the dry season. This is highly beneficial for farmers, because the upland crop during the dry season generates a better income. The question is: What impact does this shift have on the environment? Upland cropping systems are notoriously less sustainable than flooded systems. So we have the question of direct impact on the paddy – will it be sustainable? We have very good evidence from research at IRRI, where, for ten years, we have been comparing in a quite rigorous scientific manner the continuous paddy rice production in a rice–maize system, i.e. in paddies where rice is rotated with maize every other season, to that in a rice–rice–rice system. We have found that in the rice–maize system there has been a precipitous drop in soil organic matter. This soil organic matter is certainly believed to be a source of nutrition for the plants, and also a carbon sink. In other words, irrigated rice paddies in Asia are in fact sequestering carbon. As the production system shifts to rice upland crops and the soil organic matter content drops, the carbon that was fixed in the organic matter goes off into the atmosphere as a greenhouse gas. Thus, a system that was sequestering carbon can actually turn into a carbon-producing system.

InfoResources: Is this also a problem with regard to the System of Rice Intensification (SRI), which implies only part-time flooding?

Robert Zeigler: It could be. We do not know. This is one of the things we need to look at.

In terms of the rice–environment interaction, climate change is a very important area that we will be looking at. For example, we have the situation that these systems are changing, and the changes in these systems are being driven by social forces, such as reduced labour and reduced water availability as a result of competition with industry and urban areas, as well as economic forces, such as labour migration, and sometimes the labour that is required to grow rice is more demanding than other. So we have social and economic forces driving changes in our production system which, in turn, have an impact on the environment.

There is also another dimension in the influence of climate change on rice cultivation: As the temperature in the atmosphere rises, the weather patterns change, we get much more violent storms, or shifts where droughts or flooding may occur. This has a direct impact on the rice plant, so we need to develop a rice plant that can withstand these changes in the environment. We certainly need to have a rice plant that is more tolerant of flooding. We have more violent storms and more intense typhoons, we are going to see more flooding, I do not think there is any question about that. More violent storms, thermal expansion of the ocean and the resulting rise in the sea level raise the issue of seawater encroachment, so we are going to need rice plants that tolerate salinity better. With changes in rainfall distribution we can expect that areas which did not experience drought in the past will be experiencing it in the future, so we are going to need rice plants that are more tolerant of drought.

The interesting thing is the convergence of the research agenda: If we look at what we require of the rice plant in terms of climate tolerance, we see that it is precisely the same set of requirements that we have for the rice plant in poor rainfed environments. This enables us as an institution to pursue questions related to poverty alleviation and questions related to climate change, knowing that our work will contribute to both areas. It is a generator of efficiency for us. And I can tell you that when we started our strategic planning we did not realise that. It was very nice to see that issues that are completely different and of which you would never think they could come together in a research agenda, in fact do come together. To me this seems a good reason why it is good every now and then to go through a rigorous planning process: You see things you did not necessarily see before. That was just one idea as to where social, economic and environmental forces come together in a research agenda.

InfoResources: There are warnings that in some years there will no longer be enough rice because, especially in China, industrialisation takes up more and more land. In your opinion, is this also a challenge that you will have to deal with?

Robert Zeigler: Yes, we are concerned about the agricultural policies of China and India. They are the two biggest players in terms of rice production and consumption. The trends are disturbing in that we see that over the last several years, China, previously self-sufficient with regard to rice, has entered the international market as a buyer of rice. This causes some spikes in the international rice price. So yes, it is a concern. If the international price of rice goes up, the ability of other countries to buy rice on the market obviously declines – they have to compete with China, which is not something you want to do. The same goes for India. This year there is quite a controversy in India about wheat imports – they are planning to import wheat and that is causing quite a stir. The same thing is going to happen with rice.

InfoResources: Is the rice exported to China of the same quality as the rice that the poor eat? I always thought that the poor eat broken grains, while the good rice is exported. This makes me wonder whether the competition is really that tough.

Robert Zeigler: The rice imported to Africa to some extent consists of broken grains – it contains 25–30% of broken grains as opposed to 2%, I believe. This is the cheaper rice. It is hard to find out how much of that is available on the market. China is not going to import rice of that quality; they are going to import a higher quality. But nevertheless this is going to have an impact across the whole rice sector. The price of the broken grains will be driven right up with the rest of it. If you have 25% broken grains, even in the worst quality rice, 75% are not broken. So it is a question of how you separate your rice. A lot of those broken grains go to the beer industry anyway. As incomes rise, so does beer consumption. So there is a competing market for broken grains. We laugh about this, but it is true. As an example, in the mid nineties Malaysia was pursuing a trend towards 50% self-sufficiency with regard to rice. One or two years ago they decided to go up to 70%. Just a couple of weeks ago I read that Malaysia now wants to go up to 90% self-sufficiency. The reason is that they cannot rely on the world market. Malaysia has plenty of land to grow rice – other countries may not be so fortunate. And so the question is, as the price of rice goes up, whether there will be other commodities to come in and fill the gap. I do not know.

The U.S. is moving massively towards ethanol production with their maize, taking it out of animal feed and putting it into ethanol production. China was importing maize from the U.S. Where are they going to get their maize for their animal feed now? I can tell you where: They are going to be converting rice paddies into maize for animal feed. And then we go on to the climate issue and the issue of where the rice supply is going to come from. If the rice supplies drop, what will the poor eat? If there is no alternative to rice but the price goes up, they will eat less. And to me that is unacceptable. The big unknown and – I think – the real opportunity are the rainfed systems. Half the rice area in the world is rainfed, currently yielding about 3 tons per hectare or even less. If we can get the right traits into the rice plants in half the rice-producing area in the world we can meet future rice demands. If we do not, we are going to be facing a problem.

InfoResources: But how strongly are the poor really affected by these economic developments, if they do not produce for the market?

Robert Zeigler: Many of the poor in rice-growing areas do not even produce enough for their own consumption. In Bengali in Bangladesh there is a special word for the end of the dry season: it is called the "monga", the hungry season or hungry month. In many of these areas the poor have two or three months every year where they know they are not going to have enough to eat. So they are affected. And the first thing to do is to raise production so that they can have enough to eat the year round. Not only rice, but that will allow them to diversify their systems. Then they should be enabled to produce an excess, a reliable, dependable excess, so that they can sell it on the market. Then, as these other market forces come to bear, their rice will compete quite reliably and generate income for them.

InfoResources: Another question. When people move to the cities, land is left behind. What happens to that land? Is it available for rice production, or is there an ownership problem?

Robert Zeigler: The problem we have in land tenure – and I honestly do not have a solution for it – is that families are very unwilling to sell land, but they also tend to divide it up among their children. This means that land holdings become smaller and smaller from generation to generation. I am not sure how societies are going to respond to that. Certainly, there are technologies for growing rice effectively on small plots, there is no question about that. But it requires a lot of work, and then there is the issue of rice-growing becoming less popular as a livelihood basis. You can either slave in the mud and grow rice or you can go to work in an assembly line building memory chips for an i-Pod. Making rice a more glamorous kind of undertaking would mean a big step towards assuring that sort of activity.

InfoResources: Is the maximum possible yield in rice already reached? Can we still increase yields with the existing varieties or do we have to change the plant?

Robert Zeigler: We do need to change the plant. But this is nothing unusual, this is not a surprise. For the rainfed areas that I have been talking about, we definitely need to change the plant in terms of the traits I already mentioned. Regarding the intensive systems, the best farmers have more or less reached the level that the best experiment station can achieve. Hybrid rice may indeed offer an opportunity to raise the yield potential of the rice plant. We are looking at some very long-range questions about changing the way rice effects its photosynthesis from C3 to C4 (*InfoResources: [background information on C4](#)*). Like with any long shot, it is unlikely that we will be successful, but certainly we will never be successful unless we try. We may fail, this is even probable if we try, but we will certainly fail if we do not try. So I think it is worth the investment. That would push rice yields up by 30%. If we could achieve this goal, coupled with the traits that I have talked about for the rainfed lowlands, I do not think we would have to worry about rice production fifty years from now, we would be able to do it.

InfoResources: Does any plant exist with that change from C3 to C4?

Robert Zeigler: Well, what is interesting about C4 is that it has arisen many times independently within the grass family. So it is not a major shift. From looking at the genome sequence we know that some of the biochemical pathways already exist in rice. We know the enzymes are there. I was talking with Ingo Potrykus yesterday afternoon. He was saying that some of the morphological adaptations are already there in rice. It is a question of getting some plastids into the right cell. While it seemed like an absolutely insane dream a decade ago, now, maybe ...

InfoResources: Rice and maize come from common ancestors ...

Robert Zeigler: Yes, so I do not think the idea is completely crazy, it might be moderately crazy, but not completely crazy. We are going to invest some of our resources into it. In about three weeks at IRRI we are convening a small conference of some of the world's experts on photosynthesis. We will get together and ask the question: Are we completely crazy or is this something that we might be able to do? And if they tell us that we are not completely crazy, we will go ahead and give it a try.

Appropriate methods and technologies

InfoResources: I would like to ask a question about the methods and approaches that are used. Different approaches have been mentioned, such as the System of Rice Intensification (SRI), the Diversified Rice-based Systems, biotechnological solutions; there are people who call for organic production, there is this Golden Rice which is also a biotechnological solution, there are NGOs who say traditional varieties provide enough possibilities. There is also a general controversy about biotechnology. What is the policy at IRRI? Do you see more possibilities in one area or do you think everything can be combined?

Robert Zeigler: On biotechnology: First of all, biotechnology consists of a whole range of technologies, most of which are not even controversial. Analysis of the genome, identification of genes, marker assisted selection, tissue culture, all of those are well accepted and there is no controversy about that. There is a controversy over one section of biotechnology, and that is transformation or genetic engineering or whatever you want to call it – transfer of genes from one species to another. I think there is nothing at all to demonstrate that the technique of gene transfer is in itself dangerous. There is no evidence from anybody anywhere that the mere process of doing it is dangerous. The question is rather that of the actual trait and the particular characteristic of the resulting plant. And how it affects the people who eat it and the environment in which it is grown. I believe that this is something to look at on a case-by-case basis. I agree one hundred percent that we should be sure that the crops we produce are healthy, safe for the consumer, and benign in how they interact with the environment. In that sense I do not think there is any dispute. So IRRI will use genetic engineering in order to develop rice plants that have traits that we cannot develop using an easier technique. It is not an easy process to genetically engineer a rice plant. So, if we could find another way to generate a rice variety rich in provitamin A, we would be glad to do it. However, this is not possible. If we could find a way to generate a rice plant that has a higher iron content without genetic engineering, to prevent maternal anaemia, mental retardation in children and early death of young women – we would be glad to do it. The fact is, we cannot. Now I believe that provitamin A rich rice – if we consider the terrible consequences of vitamin A deficiency – and high-iron rice are extremely important products to produce. We will use genetic engineering to do that, and I am willing to sit down with anybody who thinks we are wrong to do that and have them try to convince me that we are wrong. When developing these plants, we will carry out the necessary studies to make sure they are safe for the consumers and do not have an adverse impact on the environment. So I think that genetic engineering does have a role in rice improvement. I think we should handle all of our technologies responsibly – just to be very, very direct about that. We believe that biotechnology does offer great promise, but that like any technology, it must be handled with appropriate and responsible care.

As for sustainable rice production – you brought up the examples of organic rice, SRI and other techniques, traditional varieties only and that sort of thing: I am not really aware of any traditional varieties cultivated over large areas using organic approaches that could be used to achieve the level of production we need to meet the demand. In terms of organic fertiliser, I do not think that there is enough cattle in these areas to produce enough manure to put on the field. And I think that if we do the numbers, the amount of pasture and other animal food you would have to feed these animals to produce enough manure, means that you would have to be clearing more land to feed the animals. Moreover, they produce a lot of methane, which is a greenhouse gas. I have not seen any numbers showing that organic agriculture on the amount of land that we have today could produce sufficient food to feed the human species. If we want to go organic, are we willing to clear the additional land that would be required? I personally think we are better off keeping it as forests and grassland. That is my personal preference, other people may have different preferences. In terms of SRI as an alternative to rice production: To me, SRI means that there are always ways we can explore to improve rice production. SRI incorporates almost every recommended agronomic approach to rice-growing. Plant healthy seedlings from healthy seeds. We know that seedlings planted earlier will achieve a better yield. The problem is that farmers will tend to transplant later, because seedlings transplanted later are more robust. A younger seedling is much more susceptible to damage from insects, much more susceptible to damage from snails. If you loose control of your water you can drown your seedling. So, if you have perfect water control, perfect pest control and perfect weed control, SRI works very well. As soon as one of these determinants falls apart you run into trouble. The maximum yields that we and many of our collaborators have been able to achieve from SRI equal the maximum yield from conventional practices. So I do not think there are any miracles out there. I think it is still a lot of very hard work and very rigorous research that will help us move forward.

Successful projects

InfoResources: Let us move to the project level. Do you have experiences with past projects where you can say a project was really a success? And afterwards: Where do you see the greatest potential for future projects?

Robert Zeigler: Thinking from a Swiss perspective, the IRRI Laos project has been a tremendous success. Laos was a net rice importer and over the last several years has become self-sufficient in

rice – I think that has been a huge success. I think the entire development of semidwarf rice varieties, which have basically been adopted throughout most of the irrigated rice production systems, has been a major success. The incorporation of disease and pest resistance into these rice varieties has been something that has enabled farmers to grow the same amount of rice with far less pesticide application. So that has been a tremendous success. In the Mekong delta, we have done a whole set of work, we have been able to sensitise farmers to the strength of their varieties, that their varieties are resilient to many pests and they do not need to spray them. We have adopted a number of very innovative approaches in terms of farmer field schools. More interesting than that is something called the "radio soap operas". We and our collaborators in Vietnam have developed these radio shows, featuring a drama every day, every week, where somebody's wife has a problem in the rice field and one of the neighbours comes over to help, and they combine the problems of the soap opera and recommendations about how the changes in technologies affect family life. A plot could feature a farmer out spraying his field, while his neighbour is sitting at home and drinking beer, saying: "What are you doing spraying your field? You are spending all your money spraying your field. You are working hard and I am sitting here in the shade having a beer with money I did not spend on pesticide." That has worked extremely well. It is about how you communicate effectively.

At any rate, the list of specific activities and projects that have been successful is really quite long. Look at Bangladesh as a country that is now self-sufficient with regard to rice. In 1967, in a book entitled "famine 1975", the authors recommended that the global community give up on Bangladesh and India. They were going to be basket cases – let them starve to death. Well, Bangladesh is now self-sufficient with regard to rice. That was something that IRRI worked on over the decades. We had a partnership with the Bangladeshi Rice Research Institute right from the day that Bangladesh became a country. There have been many examples like that. Vietnam likewise has gone from importing rice to exporting it.

InfoResources: But the price is high on the ecological side.

Robert Zeigler: Well, that is the next step. That is where we have to look very hard at second-generation problems. The first-generation problem is: You are starving to death. So let us get the food. The second-generation problem is: How are we going to make sure that our environment is stable enough to maintain that?

Looking to the future, I have already mentioned a number of areas that I believe are quite promising. I think there is something to keep in mind: A lot of the work that IRRI does – along with our partners, I want to make sure we understand that this is not only IRRI I am talking about – a lot of work that we do really comes to fruition ten, fifteen, even twenty years down the road. For example, the work I mentioned on submergence tolerance: We have identified a source of flooding and submergence tolerance in the late 1980s and it took until now to do all the necessary ground work to get a rice variety that can be grown by farmers. That takes 16–17 years. And so, if we talk about particular projects that are successful, those projects integrate a huge amount of work that has been conducted over many years. I think this is what we have to keep in mind: that the success in Laos or in Vietnam, or Cambodia or Bangladesh or Indonesia or Eastern India – all that is integrating a huge amount of work. When it was started we could not really say for sure how it was going to be used. You know you are working on something that is important. And I am sure this plan is full of things like that – things that we think are going to be used in a certain way. But maybe after I retire somebody is going to be using the work we did based on this plan in a completely different way. That is part of the beauty of research. Our projects that take the last step to having an impact and are successful only reflect a small part of the story and a small part of the community who works on them.

InfoResources: Nevertheless, you have to have the time and the energy to push it through. This is not obvious when you see the light only at the end of the tunnel.

Robert Zeigler: That is right.

InfoResources: Thank you very much for the interview.