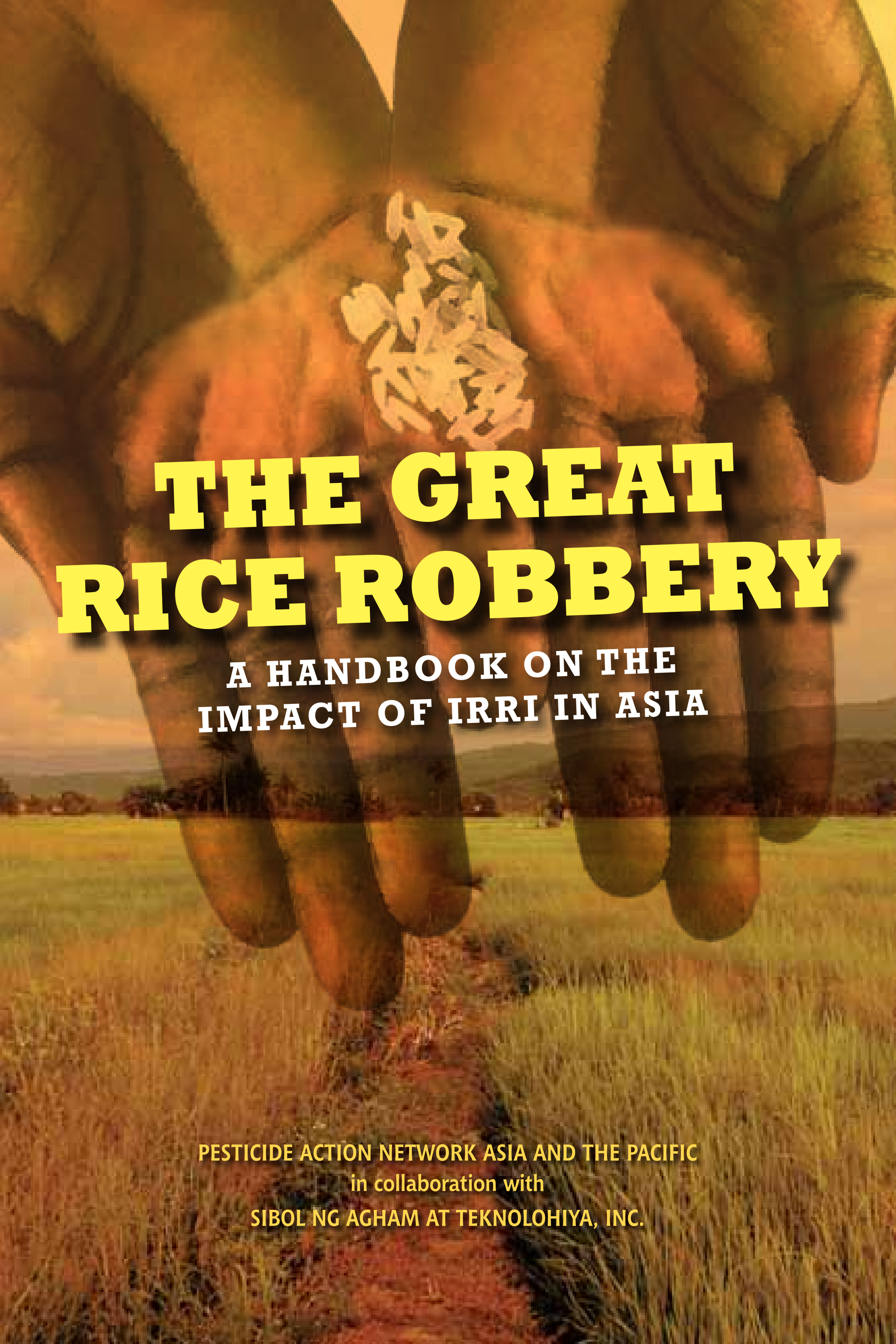

THE GREAT RICE ROBBERY

A HANDBOOK ON THE IMPACT OF IRRI IN ASIA

PESTICIDE ACTION NETWORK ASIA AND THE PACIFIC
in collaboration with
SIBOL NG AGHAM AT TEKNOLOHIYA, INC.

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THE GREAT RICE ROBBERY
– A handbook on the impact of IRRI in Asia

Authors:
Kilusang Magbubukid ng Pilipinas (KMP)
National Peasant Movement of the Philippines

Patricio M. Layosa
Brotherhood of the IRRI Support Services Group (BISSIG)

Keya Acharya
Freelance writer and correspondent
Inter Press Service, Asia Pacific and Panos Features, London

Dr. Romeo F. Quijano
President
Pesticide Action Network (PAN) Philippines

Sampaguita Q. Adapon
Pesticide Action Network (PAN) Philippines

Wilhelmina R. Pelegrina
Executive Director
Southeast Asia Regional Initiatives for Community Empowerment (SEARICE)

Pedro Aurelio Z. dela Cruz
Sibol ng Agham at Teknolohiya (SIBAT) Inc.

Compilers and Editors:
Victoria M. Lopez
Pedro Aurelio Z. dela Cruz
Jovito L. Benosa
Florinda P. Concepcion

Reviewer:
Dr. Charito P. Medina

Design & Layout:
Public Media Agency www.publicmedia.agency.net

Printer:
ICSM Printer
EDSA cor. Main Avenue, Cubao, Quezon City

Publisher:
Pesticide Action Network Asia and the Pacific (PAN AP), Penang, Malaysia
P.O. Box: 1170, 10850 Penang, Malaysia
Tel: (604) 657 0271 / 656 0381   Fax: (604) 658 3960
E-mail: panap@panap.net   Homepage: http://www.panap.net

Perpustakaan Negara Malaysia   Cataloguing-in-Publication Data

The great rice robbery: a handbook on the impact of IRRI in Asia
ISBN 978-983-9381-35-1
1. International Rice Research Institute (IRRI).
2. Rice Planting Research Asia. 633.1807205

Foreword

The International Rice Research Institute (IRRI) was set up in 1960 with funding from the Ford and the Rockefeller foundations of the US to boost rice productivity and "modernize" Asian agriculture.

In the first act to set up its headquarters in the Philippines, IRRI displaced farmers from their land and until today, the peasant struggle for their land continues.

IRRI started the promotion of the Green Revolution in 1966 with the introduction of a series of high yielding varieties of rice. Rice production in Asia doubled from 270 million tons in 1966 to 600 million tons in 2000, but poverty in Asia worsened during that time.

Despite the initial yield gains that resulted from the adoption of "modern" rice farming methods using high yielding varieties (HYVs) and high input cultivation methods, these technologies have effectively undermined the rice diversity of Asia and created massive health and environmental problems due to the use of pesticides. Prior to IRRI, farmers were growing more than 100,000 varieties of rice, but 30 years after HYVs were introduced, only five HYVs accounted for 90 per cent of the rice growing area of both peninsular Malaysia and Pakistan, nearly half the rice lands of Thailand and Myanmar, and around 25 per cent of the rice areas of China and Indonesia. These new varieties were not only vulnerable to diseases and pest attacks, but were also expensive and inferior in terms of grain quality and taste.

In the pursuit of Green Revolution technology, IRRI exposed its workers and the environment to extremely hazardous pesticides resulting in pesticide poisoning, health impacts and contamination of the environment. Health complaints from former IRRI workers who sprayed pesticides for decades were investigated by PAN Philippines and the ensuing report revealed the ill health of the workers consistent with health impacts commonly associated with the pesticides that they used. Worse, these poor workers were forced to use these hazardous pesticides at that time without any protective clothing or any training on safety measures related to the use of such poisonous chemicals. However, a Philippine Presidential Decree grants IRRI immunity from legal action, denying justice to former IRRI workers.

Now IRRI is pursuing the promotion of hybrid rice and genetically engineered (GE) rice and developing this in collaboration with agrochemical transnational corporations (TNCs) which will only intensify environmental contamination and the loss of biodiversity, while enabling monopoly and control of the rice seed by agrochemical TNCs. It has completely disregarded the local wisdom, traditional knowledge and innovation of peasant rice farmers accumulated over centuries.

Thus, it is not surprising that IRRI's anniversary on April 4 is marked each year with coordinated protests worldwide, led by a farmers' rally in front of its Philippine headquarters. Farmers, consumers, health and environmental groups, and other concerned sectors in different countries across Asia have repeatedly expressed outrage against IRRI. They have denounced its agenda geared towards profit-making by TNCs at the expense of people's livelihoods, health and food self-sufficiency, and the environment.

In March 2007, as part of the Week of Rice Action (WORA) 2007, PAN AP together with its partners in Asia launched a "One million signatures, One million voices for rice" campaign by launching the "People's Statement on Saving the Rice of Asia." The campaign met its goal in just six short months in collecting over a million signatures from all across Asia. This signified the people's opposition to the corporate agriculture agenda and their strong call for the protection of Asia's rice.

WORA was conducted in 13 countries across Asia: i.e., India, Bangladesh, Nepal, Pakistan, Sri Lanka, the Philippines, Malaysia, Cambodia, Indonesia, Thailand, Korea, Japan and China. It projected and demonstrated on an Asia-wide scale, the celebration and protection of the culture of rice, opposition to GE Rice, and a denouncement of IRRI.

To continue the campaign to save the rice of Asia and to expose the corporate agenda of IRRI, this resource book on IRRI will highlight the serious impacts of IRRI's actions and its close ties with the agrochemical industry. It is offered as a tribute to the hundreds of thousands of peasant rice farmers and agricultural workers especially in Asia who have suffered and are still suffering the full brunt of IRRI's failed experimentation through the Green Revolution.

Sarojeni V. Rengam
Executive Director
PAN AP

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Introduction

This Handbook is a compilation of researches, written on a range of perspectives by authors regarding the role played by IRRI on the transformation that took place in Asian rice agriculture in nearly over 50 years.

The objective of compiling these materials is to provide rural development workers, participants in the struggles for food sovereignty, and farmers across Asia – with substantive information and incisive analysis on the role of IRRI in the rice agricultural transformation that began to take place in Asia in the 60s – acclaimed as poverty-lifting by the United Nations' FAO and agro-chemical corporations -- indicted as cataclysmic by farmers worldwide in its wake. It is hoped that this could help better understand the issues that continue to be confronted today in Asian agriculture, particularly on the defense and protection of this invaluable staple food crop that braces the survival, sustenance and culture of Asian peoples.

The first three papers, **Historical and Political Perspectives on IRRI and its Impact on Asian Agriculture** (Kilusang Magbubukid ng Pilipinas), **The Impact of IRRI on Philippine Rice Agriculture** (Patricio M. Layosa), and **The Impact of IRRI on Rice Agriculture in India** (Keya Acharya) -- provide historical perspectives of IRRI's role, commonly taking off from the Green Revolution, the program that launched and planted modern agriculture on Asian soil. The authors commonly trace and analyze its development and impact in Asia (KMP) and in two countries that had been important to its development, Philippines (Layosa) and India (Echarya). It was in these two countries where the chemical agriculture prescription was first tested and put to yoke on the farming sector -- shortly transforming the rooted traditional rice agriculture that historically nurtured these societies. The impact studies covered impact on the sectors of agriculture (farming system, soil, seeds, water), rural farming economy, and environment – where each sector was profoundly analyzed, based on evidences and findings that were often interrelated and mutually influencing. The most important themes in the impact studies are: the resultant loss of traditional farming system tied to the seed and the subsequent loss of farmers' essential control of the seed – including control of and access to all life-giving resources in their farming environment, and their self-reliance. Yet further, the writings tell of the structural realities marked by landlessness in some rural milieu – which were deepened by the use of Green Revolution with oppressive instruments to perpetuate local elite power.

Pesticides and the Plight of Former IRRI Workers (Dr. Romeo Quijano and Sampaguita Adapon) – focuses on the adverse impact of chemical pesticides, as production requirement of HYV and of succeeding genetically engineered varieties developed in the research laboratories of IRRI. The paper discusses hazards of agricultural chemicals inflicted on humans, from findings about the unprotected exposure of several IRRI workers to hazardous chemicals in the IRRI workplace, revealing highly toxic substances that defy claims by IRRI of their avoidance. It explains the correlation of factors that lead to concluding the greater possibility of chemical contamination as the cause of defects and illnesses found comparatively more prevalent in the community of IRRI workers. The paper further elaborates on the higher health costs of pesticide use in agriculture, and made comparative insights on higher economic benefit from non-pesticide use.

Oryza Nirvana? Ten Years After – Perspectives on IRRI's Rice Breeding Program (Wilhelmina Pelegrina) is intended as an update to civil society organizations on the status and direction of IRRI's rice breeding program, 30 years after the Green Revolution. The paper critically traces the development of IRRI's modern biotechnology rice research agenda (that includes hybrid rice and Bt rice) by way of addressing the problems, issues and concerns of smallholder farmers of Southeast Asia. The paper also critically examines IRRI's sustainability framework on its researches -- as against their impact on: narrowing of farmer seed reuse and conservation, loss of farmer seed control to corporate take-over, and on environmental and health risks associated with developing transgenic rice. The paper further examines the push to develop genetically-engineered bio-fortified crops -- against issues on health, change in dietary patterns, and against a gamut of technical uncertainties on the subject. Finally, the paper critiques the top-down research method of IRRI, that remains today despite the evidences of participatory plant breeding successes and models in Asian countries.

Handing over Farmers' Rice Wealth and Knowledge to Gene Giants: an Analysis of Trends in Public-Private Partnerships in Rice Research & Development at the IRRI (Pedro Aurelio dela Cruz) is presented as an incisive and well researched document on the mechanisms of corroboration, of IRRI—as an institute for a global network of non-profit research centers under the CGIAR. It examines the global framework underlying the partnerships and the instruments that reveal the private sector interest on public research, namely, the conservation of genetic resources, basic research and germplasm. This point to a highlight of this collusion -- the germplasm mostly kept in public international and national genebanks (collected from farmers' fields and across diverse agroecosystems all over the world) as an area of public-private collaboration. The paper presents two cases of IRRI-private sector partnership in rice biotechnology research. The paper also analyzes the various mechanisms through which IRRI promotes partnership with the private sector. Finally, the paper urges the creation of a genuine pro-people research institution for public good.

The document basically informs the public that the promise of food sufficiency by Green Revolution and subsequent models were not and will not be met, as hunger stays and lurks in the vast rice growing communities of Asia.

The writings here expound with substantive research (participatory, farmer-based, and scientific researches), the role of the corporate world as well as IRRI in the loss of Asia's rice heritage. The title given this book – **The Great Rice Robbery** – is a fitting recall of the loss of the basic rice wealth that Asian civilizations and societies nurtured for ages, and lost to the rapacity of a few. And IRRI, from evidences compiled in this document, has been a central instrument to this. ■

Historical and Political Perspectives on IRRI, and its Impact on Asian Rice Agriculture

HISTORICAL AND POLITICAL PERSPECTIVES ON IRRI, AND ITS IMPACT ON ASIAN RICE AGRICULTURE

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Historical and Political Perspectives on IRRI, and its Impact on Asian Rice Agriculture

Kilusang Magbubukid ng Pilipinas (KMP)

Rice is produced globally on more than 150 million hectares with an annual production of about 600 million tons. Asia produces more than 91 percent of the global harvest, accounts for up to half of its farm incomes and makes up 80 percent of people's daily calories (GRAIN, 1998). The importance of rice and rice-based systems thus, is understood by multitudes of rice farmers all over the world to mean their food security and livelihood. Further, *the rice crop is embedded as core of traditional agriculture, a fundamental link to the struggles for land and resources, and is the center of socio-cultural life and heritage of many Asian societies.* It is best summed up by a statement from peoples' movements and NGOs across Asia: "Rice means life to us in Asia. It is the cornerstone of our food systems, our languages, our cultures and our livelihoods for thousands of years."

The place of rice in Asian agriculture had been radically threatened and transformed since the incursion of the Green Revolution technology in the 70s. This was upon the instigation of US corporate interests and agenda, and facilitation of their creation – the International Rice Research Institute or IRRI.

GREEN REVOLUTION AND IRRI

Green Revolution or GR is both an ideology, defined as the large-scale application of modern agricultural science and technology in rural development, and a program package through the extensive and intensive use of modern production technology and of HYV seeds (D.N. Dhangare). Large economic interests by oil and chemical-based industries financed and pushed the scientific research and product deployment (introduction and widespread adoption) in the late 1960s and 1970s often exercising political maneuver to yank open Asian agricultural markets.

IRRI was the primary institution, built to undertake research on the plant type that would be efficient in using solar energy and fertilizer to achieve high yields. The research activities by IRRI began in 1960, with a canvass made of the world's rice repositories, then collecting 10,000 varieties in order to find the most suitable rice strain. The first HYV (International Rice 8 or IR8) was released in 1960 in the Philippines.

The adoption of HYVs spread quickly in Asia. By 1970, about 30 percent of the rice area in the Asian region was devoted to HYVs, increasing to 70 percent by 1990s. But more than the introduction of new seeds was the start of a transformation of many traditional agricultural systems, then the basis of food security and development of Asian rural societies. In the coming decades, GR became the dominant orientation and model for rural development programs in India (D.N. Dhangare) and in many Asian countries.

In the host country, Philippines, GR was made as the centerpiece of a government countryside program to spruce up a sham response to the clamor of peasants for genuine land reform. At the same time, GR became a means for the dictator president and his cronies to consolidate their power in the countryside as well as advance their business interests during the dictatorship era.

IRRI AND THE US AGENDA IN ASIA

It is important to understand that there was a hegemonic intent to sow GR in Asia, behind the rhetoric to increase rice productivity for Asians, and that IRRI has played a role in realizing this intent.   US corporations wanted new markets for their products, new investment opportunities for their surplus capital, and more favorable trade relations with the Asian neo-colonies. 'Modernization' of Asian agriculture was essential to the US to create an environment where foreign investment and export-oriented production were to generate growth.

The US also concluded that the political and economic unrest plaguing the poor nations in Asia (after the Chinese revolution and the Korean War), cannot be averted by military means alone, i.e., unless reforms are made in the backward agricultural sectors of the Asian countries under its control. At the time too, South Vietnam was rife with peasant unrest and the influence of communism was rapidly increasing.

Hence, the search for new products to placate the growing poverty-stricken populations, and open new markets in their countries connected well under the GR agenda. Thus, IRRI is said to have been established by its proponents to undertake scientific research where outcomes would help transform agricultural landscapes and the lives of agricultural producers in agriculture-dependent nations, as well as diffuse the peasant unrest brewing in their midst.

The US picked the Philippines for IRRI's headquarters because of the Marcos governments' open and dependable predisposition to US corporate dictates. Analysts further say that GR was evidently used as a reform campaign to dissipate peasant revolt in its hotbeds in major rice producing regions in Luzon. This could be affirmed by a statement made by the Rockefeller Foundation in 1951: *"There was a special problem in the Philippines in regard to the relations of hunger and the appeal of communism, and that there was perhaps a special responsibility on the part of the United States government to do something about agriculture in the Philippines."*

Vandana Shiva stated: "Alarmed by growing peasant unrest in the newly independent countries of Asia, agencies like the World Bank, the Rockefeller and Ford Foundations, the US Agency for International Development and others looked towards the intensification of agriculture as a means of "stabilizing" the countryside - and in particular of defusing the call for a wider redistribution of land and other resources. Above all, the US wished to avoid other Asian countries' following in the revolutionary footsteps of China. In 1961, the Ford Foundation thus launched its Intensive Agricultural Development Programme in India, intended to "release" Indian agriculture from "the shackles of the past" through the introduction of modern intensive chemical farming."

Finally, in 1959, the Rockefeller together with Ford Foundation forged an agreement with the Philippine government for the establishment of IRRI in Los Baños, Laguna. During that same period, the IMF and the World Bank started to play their role in restructuring the Philippine economy. The debt of the Philippines to these institutions, and consequently their influence in domestic economic policy, would increase until the present. The World Bank continues to fund and influence policies favorable for IRRI.

The entry of IRRI into Philippine territory was not without breaching the civil rights of Filipino farmers and local landowners. This was done through the arm of Presidential Decrees (PD) 457 and 1046-A issued by the Marcos government in 1974, under martial law, which gave IRRI the legal authority to occupy the farmlands where it built its research and operations structure. Said land was thus forcibly taken from the farmers, who finally were forced to sell for less than their lands' worth.

IMPACT OF GREEN REVOLUTION (GR) ON ASIAN AGRICULTURE

The Food and Agriculture Organization (FAO) of the United Nations reported that since GR, the Asia-Pacific region had been then on the forefront of generation and transfer of modern agricultural technologies, recording the highest agricultural production growth rate (about 4 percent) during the past two decades (from the 70s). The GR is said to have ushered in thorough development and adoption of HYVs of rice and wheat, more than doubled the productivity of these crops (FAO, 1994).

Indeed, by 1970 about 20 percent of the wheat area and 30 percent rice area in the Asian region were devoted to HYVs. By 1990s the share increased to 70 percent for both crops, i.e., the changes were more than doubled in cereal production in Asia between 1970 and 1995. In recalling an overall impact through statistics, a paper published by IFPRI states the sizable increase in incomes, stimulation of overall rural non-farm economy, and decline in overall poverty between 1970 to 1995 to less than one third, where absolute numbers fell from 1.15 billion to 825 billion (Peter B.R Hazell, 2003). Statistics also drew a picture of hungry people in 1970 vs. 1990. They indicated that the total food available per person in the world rose by 11 percent over the two decades, and the estimated number of hungry people fell from 942 million to 786 million, 16 percent drop (Rossett, 2000).

These gross figures however, were contradicted by a real assessment of worldwide poverty, which says that despite three decades of expanding global food supplies (through GR) there were still an estimated 786 million hungry people in the world in the 1990s. It is in Asia where GR seeds have contributed to reported greatest production success, but where roughly 2/3 of the world's undernourished in the entire world are yet found today. In India, 1/3 of India's 900 million people are still poverty-stricken. On closer look, if China figures are eliminated from the analysis, the number of hungry people rose by more than 11 percent , from 536 to 597 million (Paul & Steinbrecher, 2003).

The rosy picture painted by gross statistics on productivity and yield need to mention that production increases during the decades under GR had been achieved at considerable costs to the resource base and largely by means of heavy external input use; irrigation, seeds, fertilizer, pesticides, animal breed and feed (FAO, 1994). "The new technology was capital intensive. It commits the nation to large investments from predominantly foreign corporations. In nitrogenous fertilizer alone the indigenous capacity had to be increased from 0.37mT of nutrients in 1967-68 to 2.23mT in 1979-80 (worth 6000 cores in 1980 prices). Furthermore, production capacity had to be generated for tractors, diesel-sets, etc., and every farmer adopting this new technology had to invest his own capital to acquire these machines, which often came from public financing agencies" (Organic Farming Source Book).

The full impact of GR can be seized up along several dimensions: increased poverty, indebtedness, harm to human health, loss of biodiversity, and destruction of the environment.

Poverty, indebtedness and structural inequality exacerbated in the era of GR

Green Revolution had resulted in greater poverty, hunger and illnesses of rural populations across Asia. This is the conclusive indictment of the affected millions, voiced out through multitudes of documented cases, peoples' meetings and tribunals (The First Asian Peoples' Tribunal against IRRI, April, 2006).

Landlessness or inadequate land to till remained the yoke of peasants in feudal and semi-feudal economic circumstances in poor Asian countries. GR favored the rich because of their ability to access the package of input requirements of production. Big growers could afford and could even get discounts for large purchases, and pay for irrigation fees. Government-subsidized credit overwhelmingly benefited the big farmers and landlords. Hence, the gains of GR filled the coffers of the landlord class and the big traders of fertilizers and pesticides.

The inherent social inequalities in Asian rural societies demarcated the gains of productivity. Poor farmers cannot afford to buy fertilizers and other inputs in volume. Inequitable terms in local trading often dictated that poor farmers are shortchanged and exploited by traders. Water is a requirement of the HYV, and rent for irrigation was often out of the reach of the poor.

Hence, the GR package became a tool to further disenfranchise the poorer farmers, remove them farther away from control of and access to production. In South Asia, there was 9 percent more food per person by 1990, but there were also 9 percent more hungry people … What made possible greater hunger was the failure to address unequal access to food and food-producing resources" (Rosset et al. 2000).

Narrowly focusing on increasing production as the GR does cannot alleviate hunger because it fails to alter the tightly concentrated distribution of economic power, especially access to land and purchasing power. Even the WB concluded in a major 1986 study of world hunger that a rapid increase in food production does not necessarily result in food security – that is, less hunger (Rosset et al. 2000).

Perennial indebtedness to rural bankers, traders and merchant-usurers, is a situation introduced by GR in Asian rural areas. Making fertilizer and pesticide purchases mandatory, as in the Philippines, was a means for these entities to profit from the sweat of farmers. This deepened the problem of usury as an instrument of feudal and semi-feudal exploitation in the countryside, and led to the loss of land and resources by farmers.

Hence, increases in productivity (claimed by IRRI as the only indicator of farming success), came at a price to poorer farmers especially over the longer term. The intensive requirement of inputs to create productivity also increased over time. In India, adoption of the new seeds had been accompanied by a 6-fold rise in fertilizer use per acre. Yet the quantity of agricultural production per ton of fertilizer used dropped by 2/3 during the GR years. In fact, over the past 30 years, the annual growth of fertilizer use on Asian rice has been from 3 to 40 times faster than the growth of rice yields. In West Java, Indonesia, 23 percent yield increase was virtually cancelled by 65 to 69 percent increase in fertilizer and pesticides respectively (Rosssett, 2000).

In Central Luzon, Philippines, rice yield increased to 13 percent during the 1980 but came at the cost of a 21 percent increase in fertilizer use. Along these lines, fertilizer became a critical input into rice production, and of the total area planted for rice in 1988, about 68 percent was applied with fertilizer. And in 1997, the ratio increased to 86 percent , translating to an average use of 4.4 bags of 50 kilogram of fertilizer per hectare where the intensity of fertilizer use in irrigated rice farms is higher than in non-irrigated. Studies by the Department of Agriculture's Bureau of Soils and Water Management (BSWM) revealed that the increased use of nitrogenous fertilizers had led to soil problems (imbalanced plant nutrition causing increased deficiencies in major plant food nutrients, including a number of micro-nutrients such as zinc and boron. The single use of urea likewise resulted in sulfur deficiency in major-rice producing provinces located on light soils.

The claim of GR is that its scale neutral because it delivers increased annual harvests, higher yields and more work for laborers leading to higher wages. This was not the case in many rural farms, such as in

Uttar Pradesh in India which reported decrease in real farm wages by 18 percent because of influx of machinery and migrants to compete with the local labor and the landless farmers.

FAO describes the impact of GR as follows: ".. Despite its successes at increasing aggregate food supply, the GR as a development approach has not necessarily translated into benefits for the lower strata of the rural poor in terms of greater food security or greater economic opportunity and well-being. Under-nutrition and poverty are still prevalent and the distribution of food remains skewed with families in landless, small-scale farming households and general laborers as high-risk groups. Studies of impact have shown that the better-off strata of rural society have gained access to better incomes generated by the introduction of technology whereas the poorest strata have tended to lose access to income that was available before its introduction. The rapid modernization of agriculture and the introduction of new technologies such as those characterized by GR have had a differential impact on rural population by both class and gender. Two general trends are apparent: the wealthy have benefited more from technological change in agriculture than the less well-off and men have benefited more than women. Studies on the impact of GR have shown that technological change can generate major social benefits but at the same time generate significant costs for particular categories". [FAO Focus]

IRRI's high-yield creation is unsustainable

While the various international agencies had praised the successes of GR --- in terms of yield (measured in increase per capita food supply from 1961 to 1998 (Pinstrup – Anderson et al., 1999), subsequent reports account for the slowing down of growth rates of production and yields of cereals and pulses [Kaosa and etal, 1999. The growth rate of productivity of the major cereals – rice, wheat and maize – declined in Asian countries from 3.35 percent in 1977-86 to 1.5 percent in 1987-97 for rice; from 6.21 percent to 2.96 percent for wheat and from 4.04 percent to 3.34 percent for maize. Cereal yields are stagnating or falling in many areas, mainly due to micronutrient exhaustion, low pest build-up and falling water tables (Impact on Poverty and Rural livelihoods). In Central Luzon, Philippines, rice yields grow steadily during the 1979's, peaked in the early 1980's, and have been dropping gradually ever since. Long-term experiments conducted by IRRI in both Central Luzon and Laguna province confirm these results.

For South Asia, the impact of Green Revolution has been characterized by a slowing of the rate of growth of farm yields, high input-use intensity, and an apparent decreasing efficiency of inputs. Patterns if declining yield have recently been for rice-wheat systems in India and Nepal (Ibid). Overall, the slowing yield growth rates and decreasing input efficiency in irrigated rice, and low and declining yields in non-irrigated rice, have meant that the sustainability of GR rice production systems has been called into question (Ramprasad, 2005). FAO had admitted this fact: "productivity levels have not only reached a plateau but even declined in the high yielding production systems which have been major contributions to the national food basket" (FAO, 1994).

In the Philippines, long-term soil degradation as a result of GR farming is pointed to as a main cause of decreasing yield statistics, particularly in its main rice granaries. The Bureau of Soil and Water Management noted important results of soil analysis, primarily zinc deficiency found to be a major cause of low rice yields in the major rice producing provinces such as Iloilo, Cagayan Valley, Nueva Ecija, Bulacan, Camarines Sur and in flooded ricelands in Samar and Leyte, Bicol River Basin and CARAGA rice areas (Searice 2005).

In Indonesia, yield performance became stagnant since 1990s, from 4.3 metric tons per hectare to 4.4 metric tons per hectare in 2002 (Bulog). It appears that the irrigation, compaction of soil through use of heavy machinery and chemical inputs have had serious impacts on the soil health, reducing its ability to sustain health crops (Paul & Steinbrecher 2003).

Finally, ADB had agreed to these attestations: "An investigation into production performances over the past two decades has revealed some early indications of unsustainability. Firstly, the growth of yield per unit area of some major staple crops, is demonstrating a declining trend, and this slowdown is most obvious for rice. The GR package was based on a powerful technology that offered a remarkable increase in yields, which were many times greater than the yield of the more productive traditional varieties. However, it had experienced second generation problems detected by scientists in the intensive mono-cropping aspect of the system. High input use has led to increased pest resistance and health problems".

The impact, as had been said, is an intensification of the application of synthetic fertilizers and harmful pesticides, further resulting in higher productions costs, decreased incomes, and further indebtedness.

GR had poisoned farmers and populations

Poverty, food, and health are inextricably linked in a vicious cycle centered on the GR production system where pesticides are its main crutch. Pesticides, along with synthetic fertilizers, consists an unavoidable requirement of GR-style cropping but with effects that pervasively victimize the poor. The greater the poverty, the greater the level of exposure to the worst pesticides, and hundreds of millions of people are exposed to such every year. An estimated 50 million people work in plantations in developing countries and an additional 500 million in other forms of agriculture, including seasonal work (Pronczuk de Garbino et al, 2003). Many others are exposed indirectly through contamination of food, water, household dust, etc. A third form of exposure is intentional, i.e., suicide, that is mostly brought upon by indebtedness (Meriel, 2005)

Harm done by GR chemicals to users have been widely documented, and had compelled admission of IRRI that led to some consequent adjustment of its research priorities. Estimates may vary, but as the Asian Development Bank admitted, the impact of pesticide use on human health is believed to be great (Kaosa-ard & Rerkases 1999, Vol 2(3):15). Oxfam found about 375,000 people in the third world being poisoned and 10,000 of them fatally by pesticides each year. These figures do not include chronic and long-term results such as cancer, birth defects or sterility. The effects of these poisons are seen after their long use. The World Health Organization (WHO) on the other hand estimates that some 25 million workers suffer from pesticide poisoning, where 200,000 people are killed annually. The Word Research

Institute reported figures of 50-100 million people affected. That is 547 men, women and children every day killed by pesticides. Pesticide surveillance in Central America (Murray et al. 2002) .. indicated a 98 percent rate of under-reporting of pesticide poisonings, with a regional estimate of 400,000 poisonings per year, 76 percent of the incidents being work related. If the same percentage is applied to Asia, the total poisonings per year (based on the ADB 1997 population estimate of 3,538,452,000) would be 67,230,000 poisoned people. On a world scale that is 111,125,880, slightly above the 100 million estimates by the WRI. (Meriel, 2005)

Rice crop biodiversity lost to GR

Before the introduction of HYVs (and hybrid rice subsequently) mainly for irrigated fields, rice production in Asian countries was dominated by traditional or indigenous varieties under the care and management of farmers in all rice growing typologies. Rice production in the Philippines was dominated by traditional varieties which could only yield about 20-30 cavans per hectare, but are resistant to most pest and diseases and with good eating qualities (e.g., tasteful and aromatic). These varieties, numbering thousands, needed no external inputs, were accessed and kept by farmers for the next planting season, and formed the source of constant selection process mostly handled by the women.

But the widespread adoption of just a few HYVs of rice had led to the depletion and loss of traditional varieties. By the end of the century, as few as 12 varieties of rice had covered 75 percent of the fields in India (FAO Towards a New GR). A variety of rice hybrid called IR36 now extends over 60 percent of Asia where thousands of varieties used to be available to farmers before Green Revolution (Development Forum). Over the last decade of intensified collection, more than 90 percent of the seed has been either gone to industrialized countries (where plant patent legislation prevails) or to the international agricultural research centers located throughout the third world regions, outside the sovereign control of 'donating' countries and especially of the farmers who have cultivated these seeds for generations. As a result of pesticide contamination, there had also been the loss of local species that included fish, snails, and frogs from the paddy fields which are additional food sources for farmers (GRAIN, 1998).

The present state of biological diversity in Asia's paddy fields is likewise alarming. By the mid-1980s, only two HYVs occupied 98 percent of the entire rice growing area of the Philippines. In Thailand and Burma, five varieties occupy today nearly 40 percent of the total rice area, while in Pakistan the top five occupy 80 percent. In Cambodia, a single IRRI variety accounts for 84 percent of the country's dry season crop (GRAIN, 1998). Such widespread uniformity leaves Asia's rice crops in an extremely vulnerable position.

The depletion of the traditional varieties had resulted in the difficulty of farmers to revert back to them after suffering from declining yields and crop failures with HYVs. The reliance on HYVs and GR farming had been so entrenched that the GR rice farmers across Asia had lost the control and flexibility in coping with farm problems and pressures. Monocropping's crucial impact was the emergent and persistent vulnerability of the rice crop to pests and diseases.

Losses include other sections of the resource base, such as fish, snails, frogs and birds from the paddy fields, which are an additional source of food for the farmers. The pesticides also impact the health of the buffaloes. Another dietary loss is the "weeds" and wild plants that exist along with the crops, some used for food, while others used as raw materials, sometimes used by women in the production of items to be sold for additional income (Ramprasad, 2005).

Soil and water systems degraded by GR

Two-thirds of the world's agro-ecosystems have seen degradation as a result of GR. Evidences of the destruction of soil microorganisms and weakening of soil structure as a result of the intensive application of fertilizer and pesticides are all over GR farms -- through erosion, salinization, and nutrient depletion.

Pesticides, as mentioned, are the crutch of the monoculture-based GR system. Monocultures attract pests that kill both insects and natural predators, disrupt the natural balance and encourage pest resistance and outbreaks. A large percentage of pesticides do not reach target pests; the remainder is lost from the soil by leaching, run-off and volatilization, contaminate people, land, water, air and foster the emergence of resistant strains of pests (FAO, Towards a New GR). Herbicides remove the weeds which otherwise hold soil in place and provide habitat for beneficial insects (Meriel Watts, 2005).

Pesticides allow use of chemical fertilizers that produce soft disease-prone plants, and contaminate waterways and groundwater . The chemical fertilizers that come with the pesticide package allow the farmer to boost yield without using compost. But the resulting failure to return organic matter to the soil eventually leads to breakdown in soil structure and health, and build up disease and insects, and a loss of productivity (Meriel Watts, 2005).

Many of the pesticides still in widespread use in Asia are broad spectrum and therefore continue to have negative impacts on beneficial insects, birds and other non-target organisms, diminishing natural and agroecological biodiversity (ESCAP 2002).

With the decline in yield capacity of HYVs, farmers resorted to applying more fertilizers, most of which are lost to leaching, run-off and volatilization.

The intensification of agricultural production associated with the adoption of HYVS has generated a number of environmental problems related to irrigation. One such concern is salinization, which is reported in the Indus River Basin in South central Asia. Salinity now is reported to affect more than 20 percent of the irrigated land in China and Pakistan. Another problem is over-exploitation of water and thus the lowering of groundwater levels, as water is being pumped out of the ground for irrigation faster than it can be replenished (according to IRRI, it could take up to 5,000 liters of water to produce just one kilogram of rice). Over-exploitation of groundwater are seen in such areas as northwestern India and North China (FAO, Towards a New GR).

In sum, the GR technology destroys the very basis for future agricultural production by degrading the soil, depleting water supply, polluting both soil and water, and generating the problems of pests and infestation for the farmers.

HYBRID AND GE RICE: HYV SUCCESSORS IN THE ERA OF CORPORATE GLOBALIZATION

Amidst the growing protest of Asian farmers yet reeling from the impact of the GR technology -- IRRI scientists in the 1990s claimed another emergent revolutionary technology in the IRRI rice research portfolio -- hybrid rice. We are now seeing the rapid expansion of its cultivation in Asian farmlands, despite the real debate over the limited efficiency or potential to increase rice production (Dr. Durga B. Cahuadhary, Plantek Inc.). Hybrid rice was grown in over 800,000 hectares in 2002 (FAO), with the largest in Vietnam, India and the Philippines.

The entry of genetically engineered rice today is being foisted to Asian farmers, through the means of inequitable trade. GE technology is of the same face with HYV and hybrid technologies. These are TNC-driven technologies supported by multilateral and national government frameworks, with the avowed aim to raise crop productivity in exchange for profit that is bled from Asian farmers and from the control of seed resources. The methods of HYV and hybrid rice entries were rather similar – through government programs with partners: IRRI for the training support, TNCs to sell the produce, and local financing mechanisms (e.g., NGO micro-financing in Bangladesh). The potential impact of hybrid and GE technologies show all the signs to be more profound in terms of the loss or displacement of all remaining endogenous rice development potential of Asian nations and their farming sectors.

The interest of TNCs in driving hybrid and GE rice technologies go beyond mere sales profit from seeds, chemical fertilizers and pesticides. TNCs also profit from royalties and license permits from patented seeds, i.e., from expanded corporate stranglehold backed or legitimized by global patenting and IPR instruments (the TRIPS in WTO being the foremost). GRAIN reports that more than 900 rice genes have already been patented. The important traditional rice varieties of certain countries have already been patented (Basmati in India and

Pakistan, Jazmine in Thailand), where each government found difficult to challenge because of the TRIPS in WTO (Dr. Shazid Zia, Asian Peoples' Tribunal, 2006). In a GRAIN compilation of rice varieties in 2000, 56 percent of these were owned by TNC agri-business companies such as DuPont and Mitsui of Japan. The gene mapping project by Syngenta, who claims to have invented more than 30,000 gene sequences of rice, and its application for 15 groups of gene sequences covering thousands of genes and GE processes – present the scale of research and patenting efforts by just one TNC in agribusiness.

TNC control over Asian rice agriculture, in the current era of corporate globalization had then been tightened with the expansion of economic interest to cover seed control.

The remaining control of Asian farmers over their traditional seeds (the basis of traditional agriculture) is fast being constricted and taken away.

CONCLUSION

IRRI had played a central role in undermining the future development of the rice crop in Asian nations and communities. It had been instrumental in mounting the Green Revolution or the transformation of agriculture to suit the US agenda and corporate motives. It had brought intensification of problems to farmers, proportionate to the degree of structural problems in their rural societies. The gains of GR were selective and biased for the bigger farmers and landlords. The consequences for the poorer farmers had been dire and profound, in terms of increased indebtedness and poverty. In many instances, Green Revolution had led to the weakening if not obliteration of community traditions and culture, cooperativism that were so closely tied to agriculture. Local agricultural knowledge had been replaced by a dependence on external inputs, losing thereby the indigenous capacities of small farmers to plan his farm work and cope with natural stresses. The impact of GR across Asia had also led to consequent displacement of farmers and farm workers from their land and life-giving resources, such as rural to urban migration.

The current processes of globalization and liberalization through the WTO Agreement on Agriculture had further intensified the control by and had multiplied the gains of TNCs over Asian agriculture. Asian markets have been opened to highly subsidized imports from the north, threatening the remaining agricultural potentials of poorer countries, causing massive bankruptcies and displacement of farmers and agricultural workers.

The Green Revolution was a stage prepared by IRRI, for another 'revolution' now involving modern biotechnology. The Gene Revolution is again, a tool to advance the whole scale motives of the WTO to capture global market and trade. This time, the focus is on the seed, whose appropriation from the hands of farmers is being craftily machinated by the new patenting regimes through TRIPS Agreement and plant varietal protection laws. Green Revolution now serves as a staging ground for the wanton incursions by genetic engineering in Asian agriculture. IRRI implements corporate funded research on genetic engineering, paving the way for national acceptance through its lobby. The crux is, this time, there is wide and global objection and criticism of genetic engineering at all fronts – a kind of resistance that is much unlike the post-war scenario of Green Revolution incursion into Asian agriculture.

IRRI thus, is an instrument that facilitated and helped to perpetrate the dire and adverse impact on poor farmers of Asia, is guilty and should bear the weight of its offense. IRRI could not hide behind its 'public research institution' cloak, and should be made to answer to the indictment of continually serving the interests of hegemonic powers and of the corporate interests that created it.

Conditions are favorable to intensify the peasant struggle in unity with other progressive sections of society globally. The mere closure of IRRI will not solve the dismal situation of the Asian farmers but it will be another major step toward genuine land reform globally. From this, we encourage and challenge the Asian peasants to unite and consolidate their ranks and advance the struggle for genuine land reform and promote ecological agriculture against GE form of agriculture. ■

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Impact of IRRI on Philippine's Rice Agriculture

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Impact of IRRI on Philippine's Rice Agriculture

Patricio M. Layosa

INTRODUCTION

The Philippines is an agricultural country with a total land area of 30 million hectares of which 47 percent is agricultural land that are highly suitable for cultivation. The total area devoted to agricultural crops is 13 million hectares distributed among food grains (31 percent), food crops (52 percent) and non-food crops (17 percent). This agricultural wealth is the basis of Philippine economy and the cornerstone of local production and market.

A mixture of small, medium and large farms characterizes the country's agricultural landscape. Approximately 50 percent of farms are less than 2 hectares in size, making up about 16 percent of the total farm area. Meanwhile, only about 3 percent of farms are over 10 hectares in size covering approximately 25 percent of farm area. A very large part these are controlled by a few families (about 9,500 little holders or landlords).

Rice is the main staple food of Filipinos, thus, the country's most essential commodity and is often crucial to its political stability. Rice accounts for 41 percent of total calorie and 31 percent of total protein intake, where average consumption is gauged at 103 kilograms per capita per annum.

The total area of rice cultivation (both in lowland and upland areas) stands at approximately 4 million hectares: some 2.5 million hectares irrigated with 1.25 million hectares planted twice a year; 1.2 million hectares rainfed; and 0.14 million hectares upland. Palay covers about 62 percent of the national grain area.

Rice accounts for an average of 15.5 percent of the gross value added in agriculture and 3.5 percent of the gross domestic product. Some 11.5 million farmers and family members are involved in rice production, and almost 75 percent of farm household income come from rice cultivation and related activities.

Even as the Philippines is being considered as one with the highest productivity potential in Asia, rice production is still small-scale, backward and dependent on foreign technology and intensive input. It remains dominated by landlords and traders while farmers have to make even of the petty support or none at all, from government.

RICE ECOSYSTEM AND PRODUCTION

Rice is planted in irrigated, rainfed and upland ecosystems. The share in rice production from irrigated ecosystem increased from 56 percent in 1970 to 75 percent in 1997 due to increased adoption of high-yielding varieties and shorter-maturing modern varieties that are well suited to irrigate environment. Meanwhile, the share in rice production of rainfed and upland ecosystem declined over three decades as shown in Table below.

Table 1. Rice Production by Ecosystem

Ecosystem	1970	1980	1990	1997
Irrigated	56%	60%	71%	75%
Rainfed	37%	37%	28%	23%
Upland	7%	3%	1%	2%

Source: Rice Statistic Handbook, IRRI

Over the period 1980-2000, the average growth in Philippine total rice production was 2.4 percent per year. In 1990s, the total rice usage or demand in the country was already regularly outstripping domestic rice production, thus, making the Philippines as a major importer of rice (see Table above). IRRI sets its maximum attainable yield at 6.30

tons/hectare while the required yield to attain food security is pegged at 5.30 tons/hectare. The Philippines, thus, had shifted from a state of marginal self-sufficiency to that of being a regular and growing rice importer.

Table 2. Philippine Rice Importation

Year	Source	Volume (MT)	Total (MT)
2003	Vietnam	287,375.00	
	Thailand	359,489.00	
	United States	41,749.15	
			688,613.15
2002	Vietnam	375,400.00	
	Pakistan	22,664.90	
	India	638,269.30	
	China	25,000.00	
	Thailand	145,250.00	
	United States	31,782.00	
			1,238,366.20

The Philippines had been among the top rice producing countries even until today. IRRI and FAO listed the Philippines in the Top 10 rice-producing countries at present standing along with China, India, Indonesia, Bangladesh, Vietnam, Thailand, Myanmar, Japan and Brazil.

PRE-GREEN REVOLUTION AGRICULTURE

Before the incursion of Green Revolution in Philippine agriculture, rice production was basically typified by single cropping per year where farmers planted mainly traditional varieties. Farm management depended purely on farmer's experiences and traditional practices on land preparation (using carabao-drawn moldboard plow), harvesting, threshing, drying, and milling. Organic fertilizer (such as guano, rice straw and rice straw ash, horse manure, copra cake, dried lye or algae, and others) was characteristically part of crop management.

Much of the production practices have been integral to the life of farmers and cultural tradition in their communities. Field tasks were executed manually but through collective effort often with relatives and neighbors in the so-called "bayanihan" spirit.

However, rice production was single cropping per year during rainy season only. Though the average rice production was only 16 cavans per hectare, in the early part of century, yield increased to 28 cavans per hectare in 1955 due to improved varieties and better seeds adopted by farmers. The increase in rice production was partly an offshoot of construction of irrigation canals and expansion of irrigated areas in 1946.

Local seed research

Local researches to develop better varieties that improved yield up to 28 cavans per hectare were undertaken by the government and the University of the Philippines College of Agriculture (UPCA)[1].

In 1930, the Bureau of Plant Industry (BPI) was then created to intensify the studies, researches and breeding aimed to increase yield. Breakthrough in rice breeding was established by BPI and UPCA in 1950 when the BPI-76 and C4-63 were released.

Notwithstanding the numerous initiatives undertaken, the rice industry was not able to perform relatively well owing to deficient support and research facilities and weak priority setting by the Philippine government.

High diversity of indigenous rice varieties

It must be stressed that before the introduction of HYVs and hybrid rice that are mainly for irrigated fields, rice production was dominated

[1] Local research on rice began in 1901 when the Bureau of Agriculture (BA) was established. Succeeding efforts were then undertaken by the University of the Philippines College of Agriculture (UPCA) where rice is being produced at the average of 16 cavans per hectare. However, with the introduction of superior varieties, the yield increased to 23 cavans per hectare in 1919 to 28.4 cavans per hectare in 1929 as a consequence of building irrigation canals in 1920.

by traditional varieties numbering more 3,000. These varieties could only yield about 20-30 cavans per hectare but were resistant to most pest and diseases and with good taste.

These indigenous varieties did not require intensive inputs and farmers used their own seeds for the next planting season. Farmers had a selection of varieties that are most suitable to their land.

THE GREEN REVOLUTION

Green Revolution (GR) came in the wake of the problems of landlessness and exploitation of farmers by big landlords and a legacy of the colonial past under Spanish and American colonial rule. Share tenancy remained the predominant form of tenurial arrangement, which weighed down on the economy of poor peasants, along with usury and poverty. Hence, peasant unrest characterized the political scenario during the years immediately before Green Revolution transformed the vast rice farming in the country. Agrarian strife was extensive as outcome of high concentration of land ownership and widespread poverty in the agricultural sector.

Green Revolution through IRRI was established in the midst of said political reality. IRRI was installed in 1960, in Southern Tagalog, a rice growing region and hotbed of peasant unrest.

The US-instigated martial-law regime of Ferdinand Marcos in 1972 launched a token land reform to soften up the peasant unrest, combined with the wave of repression of civil liberties in the rural countryside. It is in this scenario, jolted by rice shortages, when Green Revolution became entrenched with the full support of the repressive government. Through the Masagana 99 Program, Green Revolution was imposed in the form of credit packages of fertilizers, pesticides, irrigation and machinery.

The Green Revolution promised to improve rice yield by introducing High-Yielding Varieties (HYVs) and replaced the thousands of traditional rice varieties in Philippine rice lands.

The first 15 years saw an improvement in rice production shown in the table below:

Table 3. Comparative Gauge: 1965-1983		
Particular Aspect	**Pre-Green Revolution**	**Post-Green Revolution**
Average National Rice Production	4.05 million tons	7.2 million tons
Fertilizer Use	53,000 tons	344,000 tons
Powered Tillers	3,437	57,802
Irrigated Area	930,000 ha	1,514,900 ha
Wages (rice/day)	8.9 kg/day	9.8 kg/day
% Area with Double Crop	19	59
Rice Price (pesos/kg)	0.70	0.36

Source: World Food Trend and Prospect to 2025, Proceeding of the National Academy of Science, USA

The higher yield seen as a result of Green Revolution lasted until mid-80s, when the plateau and decline in yield started to become evident. A review of the Green Revolution performance throughout shows that rather, it had a very selective impact. It created far numerous problems with profound effects particularly to the lives of poor farmers.

IMPACT OF GREEN REVOLUTION TO FILIPINO FARMERS AND THE COUNTRY'S RICE AGRICULTURE

The adoption of the new high-yielding varieties had required fertilizers, pesticides, herbicides, irrigation equipment and other inputs.

The Green Revolution was consciously implemented in irrigated and high-potential rainfed areas (so-called favorable conditions), thus, many villages without access to sufficient water were left out. The owners of large farms benefited mainly from Green Revolution because of their easy access to loan or credit seeds and irrigation, capital for purchase of fertilizers, pesticides, farming machinery and equipment. Landlords with the political clout to obtain government subsidies became the major rice producers, employing many former independent farmers or share tenants as wage laborers. This greatly contributed to the disjuncture in landholdings between socio-economic classes.

While the Masagana 99 program provided credit for small rice farmers, it required the package of government-recommended HYVs and the required fertilizers and pesticides. Only 10 varieties were on the program list, successfully eradicating indigenous varieties. By 1982, 93 percent of irrigated lowlands were planted to HYVs. Making fertilizers and pesticides purchases mandatory trapped the peasants more deeply in the quagmire of perennial indebtedness.

In the chart below, it evidently shows that the monetary prerequisite for rice production is beyond the financial means of most Filipino farmers. In a study conducted by PhilRice, it shows that the average cost of producing rice in Central Luzon ranges from PhP 7.66 to PhP 9.58 per kilogram of palay. For small farmers to venture in rice production is a matter of uncertainty.

Table 5: Average Palay Production Cost and Returns in Central Luzon – *All Types of Ecosystems (per hectare)*

Item	1997	1998[R]	1999	2000[R]	2001[R]	2002[P]
Cash Cost	14,194	15,409	15,812	16,579	17,464	18,222
Seeds/planting materials	920	929	880	956	946	1,005
Fertilizer	1,796	1,896	1,690	1,824	2,206	2,151
Pesticides	560	591	527	569	688	671
Hired labor	7,668	8,458	9,050	9,313	9,562	10,211
Irrigation fee	320	323	306	332	329	350
Land tax	253	256	259	262	265	268
Rentals:						
Tools and equipment	19	21	22	23	24	26
Machine	361	399	427	439	451	481
Animal	53	59	63	65	67	72
Land	480	484	459	499	494	525
Fuel and oil	411	45	487	590	642	647
Interest on crop loan	879	1,002	1,068	1,111	1,163	1,183
Food expense	407	471	494	501	518	520
Transport of inputs	65	76	80	95	109	112

Item	1997	1998[R]	1999	2000[R]	2001[R]	2002[P]
Non-Cash Cost	8,235	7,668	7,663	8,402	8,650	9,294
Seeds/planting materials	959	968	917	997	987	1,049
Landlord share	1,557	1,572	1,489	1,618	1,601	1,702
Harvester's share	2,348	1,976	2,116	2,346	2,524	2,742
Thresher's share	1,466	1,229	1,319	1,462	1,579	1,719
Lease rental	1,553	1,567	1,485	1,613	1,597	1,697
Irrigation fee	352	355	337	366	362	385
Imputed Cost	6,832	7,369	7,675	8,133	8,511	9,109
Operator/family labor	2,042	2,253	2,410	2,481	2,547	2,720
Exchange labor	106	117	125	129	133	141
Depreciation	1,538	1,692	1,862	2,048	2,253	2,478
Interest on operating capital	1,751	1,900	1,944	2,026	2,144	2,246
Rental value of land	1,394	1,407	1,334	1,449	1,434	1,524
All Costs	29,260	30,446	31,150	33,114	34,625	36,625
Gross Returns	32,342	27,174	29,136	32,296	34,814	37,864
Returns Above Cash Cost	18,148	11,764	13,324	15,717	17,350	19,642
Returns Above Cash & Non-Cash Costs	9,914	4,097	5,661	7,315	8,700	10,348
Net Returns	3,081	-3,272	-2,014	-818	189	1,239
Net Profits-Cost Ratio	0.11	-0.11	-0.06	-0.02	0.01	0.03
Cost per kilogram, peso	7.66	9.58	8.66	9.02	8.66	8.96
Yield per hectare, kg.	3,818	3,178	3,597	3,670	3,997	4,089
Farm gate price, peso/kg	8.47	8.55	8.1	8.8	8.71	9.26

Source: PhilRice (2003), R-Revised based on validated wage rate; P-Preliminary estimates using the 2002 1st semester average wage rate

The impact of Green Revolution is evident up to the present. Majority of farmers do not own lands they till, and are bound by feudal and semi-feudal relations of exploitation as tenants, farm workers or leaseholders. Larger share of incomes went to pay the landowners while the rest went to pay the trader for the loan. Farmers oftentimes ended up with deficit or earnings not enough to support the basic needs of his family.

The case study below shows this dire reality.

Table 6: Summary of Income and Expenses in a ¼ hectare farm of a poor farmer (in PhP)

Year	Expenses		Income		Net Income
1990	Fertilizer	180.00	Harvest	33 sacks	2,080.00/cropping/
	Herbicide	120.00	Less:	7 sack thresher	3 months
	Pesticide	90.00		+ Garab	---------------------
	Labor	3,720.00		------------------	693.33 income/
	Food	570.00		26 sacks	month/30 days
		=====		x 40 kilos/sack	=========
	Total	4,680.00		------------------	23.00
				1,040 kilos	(income/day)
				X 6.50/kilo	

			Income	6,760.00	
			Expenses	(4,680.00)	
			(less)	========	
				2,080.00	
2004	Fertilizer	865.00	Harvest	33 sacks	768.00/cropping/
	Herbicide	658.00	Less:	7 sacks thresher	3 months
	Pesticide	270.00		+ Garab	---------------------
	Labor	3,720.00		-------------------	256.00 income/
	Food	1,000.00		26 sacks	month/30 days
		=====		X 40 kilos/sack	=========
	Total	6,513.00		-------------------	8.50
				1,040 kilos	(income/day)
				X 7.00/kilo	

			Income	7,281.00	
			Expenses	6,513	
				========	
				768.00	
Income Loss per Crop					1,312.00
Income Loss per Month					437.33

Source: Pamanggas, Ang Pambansang Kalagayan at Pakikibaka ng Magsasaka sa Ilalim ng Rehimeng US-Macapagal-Arroyo.

Indebtedness and landlessness

Indebtedness is often a result of crop failure brought about by degraded lands, depleting resources, inadequate access to irrigation, pests' infestation, and decreasing yields of High-yielding Varieties. Frequent typhoon and other calamities often worsen the situation. As a result of heavy losses, most likely their land is to be pawned off to pay for debt. These adverse conditions pressed the farmers more deeply in the quandary of perennial poverty, causing malnutrition and illiteracy, which are a common lot among rural poor women and children.

As result of indebtedness and landlessness, farmers become nomadic farm workers commonly vulnerable to exploitation and unfair labor practices. The number of jobs created in agriculture has fallen from 128,000 in 1996 to 44,000 in 2004. According to IBON Foundation, rural unemployment now accounts for 41 percent of total unemployment resulting to intensified poverty in the countryside. The real wage for agricultural workers is presently far beyond the amount projected to sustain the daily expenses. The daily cost of living in the rural areas had been pegged today at PhP 552.40, explaining why most peasants are living beyond the poverty threshold today. In surveys released by Social Weather Station in 6 July 2006, hunger ranged from 12.0 percent to 16.7 percent in the four quarters of 2005, and from 13.9 percent to 16.9 percent in the first three quarters of 2006. Hunger is worse among rural households reaching almost 18 percent.

Dependency on expensive inputs had resulted to increasing number of small farmers going into debt from crop failures, which in many cases resulted in the loss of their farmland to the creditor or loan shark. Unemployment, hunger and malnutrition became the certain consequence.

Loss of food resources, nutrients and traditional rice varieties (TRVs)

Rice is not just grain for poor Filipino farmers; it provides straw for thatching and mat-making, fodder for livestock, bran for fishponds, and husk for fuel. These products are valuable input to other income-generating enterprises that provide a livelihood for many rural poor, particularly women.

The increasing production of staples displaced the raising of local fruits, vegetables and legumes that are major sources of micronutrients.

Due to the loss of diversified crops in the farmers' fields, micronutrient (such as iron, zinc, vitamin A, selenium, iodine, etc.) deficiencies had became notable. Such had been attributed to the introduction of the Green Revolution varieties of rice and corn which lacked these and other compounds and essentials to health.

Although the Green Revolution has significantly increased crop yields, it is not without costs in terms of increased dependence on fertilizer and a reduction in genetic diversity. One of the much-applauded developments of the Green Revolution was the strain of rice known as IR8. When it was hit by serious disease, farmers switched to IR20, which soon proved fatally vulnerable to grassy stunt virus and brown hopper insects. Again, farmers resorted this time to IR26, a super-hybrid that turned out to be resistant to almost all diseases and insect pests but was too fragile for the strong winds. Those who have tried to revert back to indigenous varieties found that only very few have been left or most had become inaccessible to farmers. The Green Revolution had effectively removed on-farm biodiversity, i.e., the traditional varieties of rice from the farm, in the course of the promotion of high-yielding varieties.

Thousands of traditional varieties are kept in the International Rice Genebank managed by IRRI under the CGIAR auspices, but their accessibility to farmers is not a concern of IRRI. Even PhilRice, which supposedly undertakes the conservation of indigenous varieties, does not preserve and breed traditional varieties of rice.

Displacement of farm workers

Mechanical pumps, tractors, threshers, reapers and other machineries contribute immensely to raising yield and output, but there is considerable evidence that their net effect in employment is labor displacing. It also removed an important source of employment from the rural economy, hence, pushing further down rural wages and encouraging exploitative labor practices.

The increase in rural unemployment in those areas where mechanization had proceeded rapidly had been significant, shown by the growing number of unemployed farmer and farm workers' families leaving the countryside to join the swelling urban slums.

This displacement had been worsened in the 90s by the impact of the WTO-Agreement on Agriculture, affecting not only the overall performance of agriculture but also the demand for farm workers. The influx of cheaper imports coupled with their high cost had drastically reduced the desire of large farm owners to engage in production and therefore had lessened the employment opportunity for rural workers.

Decline in yield

High-yielding Varieties are more prone to pests and diseases compared with traditional cultivars, thus, requiring high level of pesticides. The incessant planting of a few genetically related and similar HYVs, often under double or triple cropping over a wide area, had led to the appearance of new biotypes of insect pests. The indiscriminate use of wide-spectrum insecticides had reduced the natural enemies of rice pests and had led to pest resurgence causing large yield fluctuations.

As a result, farmers are now using higher levels of inputs than before in order to cope with pest infestation and maintain productivity. In Central Luzon, rice yields increased to 13 percent during the 1980s but came at the cost of 21 percent increase in fertilizer use. In other regions, yields went up only 6.5 percent while fertilizer use rose to 24 percent and pesticides jumped by 53 percent. But yields have been dropping gradually ever since. The cause of this phenomenon has to do with forms of long-term soil degradation, which are still poorly understood by IRRI scientists.

Yield growth has substantially declined from an average of 3.8 percent per annum in 1970 to 1986 to 0.9 percent yearly in 1986-2001. Today, annual rice production increase stands at only 1.2 percent.

Irrigation projects have often failed to attain the expected effectiveness and efficiency of usage due to poor management. Moreover, silting, salinization and erratic weather adversely affect nearly all irrigation works. Distribution systems are generally ineffective and wasteful while water undoubtedly had become more costly.

Poisoning of farmers and their land

The avowed agricultural development brought about by the Green Revolution had incurred environmental degradation and wide-ranging health problems arising from constant exposure of farmers to agrochemicals.

Pesticide poisonings and related health hazards are prevalent among farmers and field workers simply because majority of these hapless people are uninformed or with little knowledge on the ill effect of chemicals to humans and their environment. They have no access to adequate training and sufficient resources to acquire appropriate protection. Since information drive and social services are rarely delivered in remote or far-flung rural areas, farmers cannot avail of any medical consultation or basic check-up to monitor their health condition. One study conducted by students from University of the Philippines in Los Baños, concluded that the cost to farmer's health outweighed the benefits gained from pesticides.

According to the Department of Health (DOH), pesticides and/or fertilizers are dangerous chemicals and that constant exposure over a long period of time can cause sterility, birth defects and cancers. The effects of these poisons are seen after their long use. Ironically, dangerous pesticides that are banned in some countries are still being sold here in the Philippines such as: DDT, Chlordane, Aldrin, Dieldrin, Endrin, Pentachlorophenol (PCP), Parathion and Organotin (Brestan)[2].

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[2] Several pesticides were banned and restricted in the Philippines such as 2,4,5-T, Aldrin, Azinphos Ethyl, Chlordane, Chlorodimeform, Copper Aceto-Arsenic, DBCP, DDT, Dieldrin, EDB, Elemental Phosphorus, Endrin, EPN, Gophacide, HCH/BHC, Heptachior, Leptophos, Mercuric fungicides, Parathion-Methyl, Parathion-Ethyl, 1-Naphthylthiourea, Nitrofen, Organotin, Sodium Flouroacetate, Sodium Fluoroacetate, Strychnine, Thalium Sulfate and Toxaphene.

These pesticides are poisons but were the main pillars of Green Revolution. Residues from persistent pesticides that build-up in the food chain and contaminate the environment had inflicted immeasurably to human health and wildlife.

Environmental degradation

Excessive and inappropriate use of chemical pesticides have polluted waterways and killed beneficial insects and other wildlife in Philippine ecosystems. Organochlorides that include DDT and Dieldrin which proliferated in the earlier Green Revolution years are found not to easily break down in the environment, revealing traces in the food chain.

Heavy fertilizer applications are producing nitrate levels in drinking water that exceed tolerable levels, while pesticides have eliminated fish and weedy green vegetables from the fields and thus in the diet of poor farmers.

Irrigation practices have created significant problems of salinization, waterlogging, and lowering of water tables in certain areas. Ground water levels are found receding in areas where water is intensively being pumped for irrigation. IRRI also contributes immensely to degradation of the environment specifically of communities surrounding their experimental fields in Bay and Los Baños, Laguna, particularly the nearby streams and other waterways leading to Laguna Lake. IRRI has no water treatment or waste disposal facilities.

IRRI is also guilty of direct toxic waste pollution of the populated surroundings. Wastes including those marked as "hazardous material", are being disposed indiscriminately in vacant lands adjacent to the residential areas. People, especially children, are getting sick, suspected to be caused by the thick emission from burning wastes. Livestock and domestic animals had been reported to perish from said toxic emission causing significant income loss to farmers.

GAIN FOR TNCS

IRRI's Green Revolution has proved very lucrative but only for the agrochemical industry. They earned huge profit from sales of chemical fertilizers and pesticides as attested by the figures on Table 7 below. The Green Revolution basically aims to increase food production but which was closely tied to the transformation of agrarian social and economic relations, by integrating once isolated rural areas or farmers into the capitalist market system. The modernization of the countryside, which has been an important part of the so-called nation building throughout the postwar period in Asia and during the time of communist resurgence in the Philippines, was facilitated by the dependency of the new technology on manufactured inputs, i.e., farmers adopt to the new HYVs must buy the necessary complementary inputs in the market.

The proponent of Green Revolution, in connivance with the agrochemical TNCs, have invested capital and exerted efforts to change the rural social structure and individual attitude of peasants in such a way that new capitalist institution can function more efficiently in the Philippines. They succeeded in replacing the traditional social systems by capitalist orientation complete with all its business-based social relations. This had effectively opened Philippine agriculture as market for agrochemical TNCs.

Table 7: Top 10 Agrochemical Companies - 1998 Sales and Market Share

Company	Sales (US$ Millions)	% Change (1997)	Market Share (%)
Novartis (Swiss)	4,152	-1.1	13.4
Monsanto (US)	4,032	23.0	13.0
DuPont (US)	3,156	26.0	10.2
Zeneca (UK)	2,897	8.3	9.4
AgrEvo (Germany)	2,410	2.5	7.8
Bayer (Germany)	2,273	0.2	7.4
Rhone-Poulenc (France)	2,266	2.9	7.3
Cyanamid (US)	2,194	3.5	7.1
Dow Agro-Sci (US)	2,132	11.0	6.9
BASF (Germany)	1,945	4.9	6.3

Source: The Politics of Pesticides, KMP, April 2000

GREEN REVOLUTION PAVED THE ENTRY OF HYBRID AND GENETICALLY-ENGINEERED CROPS IN THE PHILIPPINES

In 2002, genetically modified corn was approved for commercialization or distribution in the country, after a period of controversy-ridden testing and violent dispersal of resisting farmers in southern Philippines.

Green Revolution had made it easy for the entry of Genetic Engineering (Bt corn) into Philippine lands, the latter peddled by Monsanto traders as just another hybrid variety with better yield. The continuing decline of the yield from High-yielding Varieties, then, had driven the farmers to succumb to the promise of better yield by Monsanto, just another kind of technology package, but with implications more far-reaching than Green Revolution. GE rice is anticipated to be soon introduced.

THE HYBRID RICE AND IRRI

Then again, while farmers are yet reeling from the devastating effects of Green Revolution, the Department of Agriculture (DA) aggressively promoted biotechnology through Hybrid Rice Commercialization Program (HRCP)[3] declaring that in succeeding years, the country will attain self-reliance in rice by means of massive cultivation of hybrid varieties. With 84 million Filipinos rapidly growing at 2.36 percent annually, the DA expressed optimism that increase in rice production would ensure rice security for the country and reduce rice imports.

The country's hybrid technology is a consolidated effort of IRRI and PhilRice. IRRI started the exploration on hybrid rice in 1979 while PhilRice took off the research activities in 1989. Transnational corporations have actively participated in hybrid rice program like Bayer, SL Agritech and HyRice.

[3] Hybrids are produced by crossing two inbred – genetically fixed varieties of a particular crop. Hybrids are special because they express what is called "heterosis" or hybrid vigor. The idea is that if you cross two parents which are genetically distant from each other, the offspring will be "superior", particularly in terms of yield. However, the so-called heterosis effect disappears after the first (F1) generation, so farmers cannot save and use seeds produced from a hybrid crop. They need to purchase new F1 seeds every season to get the heterosis effect (high yield) each time.

In the Philippines, the average yield advantage from 2002 wet season to 2004 dry season was 8-14 percent or roughly 400 kilograms per hectare. However, the production cost of hybrid rice production is seen to be higher than that of inbred rice. Hybrid rice varieties are also found more susceptible to pests and diseases thus, requiring higher doses of pesticides. The cost of hybrid seed is presently being heavily subsidized by the government, which is to be phased out by 2007 wet season. The production cost for hybrid rice is expected to increase much more beyond the capacity of farmers.

But despite the highly-publicized potential, hybrid rice has not been fully adopted in some Asian countries. In China, (where hybrid rice technology was developed and adopted in 1976), adoption rate has been steadily going down because scientists have not been able to produce hybrid rice with good eating quality. In the Philippines, hybrid rice cannot consistently adapt to varying agro-climatic conditions across the country.

CONCLUSION

After 46 agonizing years of Green Revolution, the Philippines had miserably failed to attain self-sufficiency in rice while the government has been importing increasing amount of rice every year. The social and economic status of farmers had remained unchanged, and had became even more miserable as attested to by the prevailing situation in rural areas, especially in the entire rice producing regions. In the Family Income and Expenditures statistic published in 2000, the poor spends about 60.8 percent to 63.6 percent of their earning on total food consumption and 23 percent to 28.8 percent of their income on rice alone. For 2006, eight out of 10 families or about 83 percent of Filipino families are described as poor. The experience under Green Revolution confirms that hunger is not primarily due to a lack of food, but because hungry peasants are too poor to buy the food that is available.

Although the Green Revolution was not designed to resolve critical agrarian problems such as landlessness, it was specifically endorsed to address hunger and boost farmers' income. But the technology, had in turn, aggravated peasant landlessness, or worsened poverty as farmers had became almost entirely dependent on costly inputs and eventually loss of control of their productive resources. The Green Revolution package is too expensive for poor and small farmers to bear and yet there is no assurance of abundant yield to offset the accrued expenses.

The real beneficiaries of Green Revolution in the Philippines

Only large farms, landlords, traders and financing institution have generally benefited from Green Revolution along with the international agribusiness, which earned huge profit from whopping trade of irrigation equipments, machineries and other input requirements such as fertilizers, pesticides, and other chemicals. Undoubtedly, the approach of Green Revolution was underlined with corporate profit all along, thus, making Southeast Asian countries virtual extension of capitalist agriculture. In sum, Green Revolution had given the Filipino farmers the following legacies:

- Environmental problems associated with the heavy use of pesticides and fertilizers and the potential for serious difficulties resulting from a reliance on genetic engineering;
- Ground water depletion, soil imbalances, which in tandem with drastic unforeseen climatic changes, could lower agricultural yields in the years ahead;
- Loss of biodiversity, food quality and health effects;
- Economic unviability and ecological unsustainability;
- Industrialization of farming with only few group of people that are making profits from the technology; and
- Introduction of new agricultural technology into the social system stacked in favor of the rich against the poor.

The tasks ahead

The harsh experiences encountered in Green Revolution, including irreversible damages as consequence, should be the focal points of resistance, not only towards IRRI in particular, but also against the Transnational Corporations (TNCs) , private foundations and even global institutions such as WB, ADB, FAO and even the UNDP. The FAO for example, unashamedly took the main role in promulgation and/or adaptation of unsustainable programs, such as hybrid rice, at the expense of poor Asian farmers. The WTO on the other hand, has been consistent in outlining and implementation of policies which promote the interest of Transnational Corporations (TNCs) resulting in the displacement of domestic food and agricultural sectors.

Nevertheless, while the on-going struggle confronting domestic landlords is essential in liberating peasantry from further exploitation, the necessity to oppose and expose the WB and the Trade Related Intellectual Property Rights (TRIPS) are equally an imperative. The WB has been promoting a "market-assisted land reform" to attune agrarian reform to the demands of "free market" globalization at the expense of genuine land distribution. Thus, this is basically retooling land reform to serve mainly the interest of big landlords, real estate investors, big agribusiness and agrochemical TNCs.

The TRIPS, on the other hand, tramples the rights of farmers and indigenous people, specifically to develop genetic resources and preserve their traditional knowledge. The Trade Related Intellectual Property Rights (TRIPS) agreement of the WTO undermines the rights of farmers and indigenous peoples to have the autonomy to save, conserve, exchange and develop genetic resources and preserve their traditional knowledge. Such "international enforcement system" intensively aims to undercut the people's initiatives to eradicate hunger and poverty by maintaining local custodial control and management of land, genetic resources and biodiversity.

Rice trade liberalization promoted by WTO had resulted in lower palay price wherein local farmers are compelled to sell their output at lower cost to compete with cheaper imported rice, further lowering the household income of peasant families who depend on rice for a living.

Finally, the Filipino peasantry recognizes the dismantling of CGIAR as necessary to complement the peasant struggle. All privileges and absolute immunity afforded to IRRI should be removed, since the institute is entirely irrelevant to the country's efforts in genuine agricultural development. IRRI along with CGIAR do not serve the interests of the toiling masses but are rather the instruments of plunder of Philippine agriculture. These corporate-created institutions must be subjected to trial for crime against humanity and their entire machinery must be dismantled. ■

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Impact of IRRI on India's Rice Agriculture

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Impact of IRRI on India's Rice Agriculture

Keya Acharya

INTRODUCTION

Rice is India's most important staple, accounting for 40 percent of food production and prevailing since millennia. The scientific name of rice, ***Oryza sativa***, is in fact derived from the Tamil name for it, 'arsi'.

India has also provided the rest of the world with the largest diversity in rice varieties. Particularly in the Jeypore region of Orissa in eastern India known as the world's richest in rice diversity, nearly 1750 varieties of rice are recorded between 1955 and 1960 by the Central Rice Research Institute at Cuttack. Even more spectacular is the genetic diversity within each species, particularly of rice. For example, one species has diversified into at least 50,000 distinct varieties. (Kothari, 1994). The M.S. Swaminathan Research Foundation (MSSRF) says that India alone still has 100,000 varieties still in use by indigenous farmers around the country. In Asia alone, there were at least 500,000 different varieties of rice.

Indigenous communities till today hold knowledge on the immense biodiversity of crop seed stocks of rice and other cereals like millet, bajra, jowar. Indian peasants and tribals have selected and improved many indigenous high yielding varieties.

HISTORICAL BACKGROUND OF RICE AGRICULTURE IN INDIA

This judicious and skilful water management of the monsoonal water-supply in many parts of India, long before the advent of the British, allowed for the growth of a healthy and genetically diverse agricultural rice system since millennia. Indeed, there is evidence to suggest that rice cultivation to the north and west of the Deccan Plateau, that is the Gangetic Plain and Tamil Nadu in south India, was an important agricultural activity as far back as the 2nd millennium BC. *(www.india_resource.tripod.com/indianagriculture)*

In the 1st millennium BC, invading Aryans destroyed the Harappan cities but rice and a wide range of other indigenous crops such as millet continued to play an important role in the growth of new cities.

In 300 BC, Megasthenes, a Greek envoy to the court of the Mauryan empire, which comprised nearly the entire subcontinent and territory to the northwest, wrote in his 4-volume Indica that, "India has many huge mountains which abound in fruit-trees of every kind, and many vast plains of great fertility. . . . The greater part of the soil, moreover, is under irrigation, and consequently bears two crops in the course of the year". By the time of the Mughals, who ruled the entire northern India in the early 15th century, agriculture had broadly been divided into rice zones and wheat and millet zones. Besides Gujarat, rice predominated in the east, southwest and Kashmir and through irrigation into Punjab and Sind.

Until today, indigenous communities throughout India continue to reap, thresh and winnow the rice crop exactly as described in the Vedic texts. Grain is harvested with a sickle, bound in bundles and threshed by bullocks treading on it or by hand pounding. The sickle and sieve remain today as they were more than two millennia ago (Ancient Indian agricultural history from Encyclopedia Britannica).

The British interregnum

Indian agriculture began to experience peasant rebellions before the advent of the British, most notably the Sikh and Mahratta revolts against the Mughals, when corrupt regimes began overtaxing the peasants. The British first took advantage of these peasant rebellions by appointing officious and overbearing intermediaries to collect taxes, and exploited the farmers too by taking two-thirds of crop yields.

This led gradually led to the destruction of traditional water structures and their ancient cultural traditions that helped build and preserve these beautiful systems. An example of this was the neglect and decline of the ancient community water irrigation systems in the historically drought-prone district of Kolar, in Karnataka, in southern India, found in the Eastern Dry agro-climatic zone of the Deccan peninsula. The area had historically depended on these water systems designed to catch and store the run-off from catchment slopes, for its water needs.

The exploitation of the colonial era also saw not only the disappearance of community water-practices, but the changes in food crop patterns. The British drove agriculture for maximum economic gain with commerce crops such as tea, coffee, indigo, opium, jute and others, thus causing food shortages. Between 1770 and 1880, there were as many as 27 food scarcities and famines in India; as many as 20 million Indian lives were lost in around 20 famines since 1850 (Devinder Sharma), the most infamous being the Bengal Famine of 1942 where close to 4 million people died from starvation and malnutrition.

The British interregnum led to great neglect of India's agricultural wealth. It is generally agreed that throughout the 19th century, agricultural productivity either declined or stagnated at a low level. At the end of the British rule the average yield of paddy in India had declined to one ton per hectare. For the first time in the long history, India failed to produce enough food for the people and animals aggravated by devastating famines in different parts of the country (Ramprassad, 2005). Pre-independence India thus suffered numerous droughts, famines and food shortages, which continued in the direct years after independence from British rule in 1947, with India depending on imports and handouts.

The Green Revolution, its early stages in India

Until the 1960s, India was successfully pursuing an agricultural development policy based on strengthening the ecological base of agriculture and the self-reliance of peasants. Land reform was viewed as a political necessity and, following independence, most states initiated measures to secure tenure for tenant cultivators, to fix reasonable rents and to abolish the zamindari (landlord) system. Ceilings on land holdings were also introduced. In 1951, at a seminar organized by the Ministry of Agriculture, a detailed farming strategy—the "land transformation" programme — was put forward. The strategy recognized the need to plan from the bottom, to consider every individual village and sometimes every individual field. The programme achieved major successes. (Vandana Shiva)

By the mid 1960s, India's agricultural policies were geared to pushing self-sufficiency in food grains (India then was almost completely dependent on imports and handouts). It was then argued that the Green Revolution provided the only way in which India could increase food availability. The first steps were via the introduction of the new "miracle" seeds developed by Norman Borlaug, under a programme called New Agricultural Strategy. Twelve new IRRI seed varieties, including Taichung Native 1 and Taichung Native 3, became the parental lines for developing new High Yielding Varieties (HYV) in India.

The initial links with IRRI, involving the Agriculture Minister C. Subramaniam, and the Indian Council of Agricultural Research's (ICAR), and its two main rice research hubs, the Central Rice Research Institute at Cuttack and the Directorate of Rice Research at Hyderabad -- led to the signing by then director-general of ICAR, Dr. M.S. Swaminathan, of a memorandum of understanding with the director-general of IRRI, Dr. N.C. Brady, on co-operation in research and training in 1974.

Since then IRRI's involvement in Indian rice has grown manifold; there are now about 47 research and development projects and 52 national institutes in India collaborating with IRRI in various areas of rice research. According to the MOU, ICAR and IRRI review said research collaboration every four years.

India then started the first of its 5-year policy-programs, with intensive focus on agriculture and 'grow more food', involving research and experimentation with higher yields, productivity and inputs. Agriculture Minister Subramaniam advocated for this policy in the Indian Parliament: "..The new policy is whether we go in the same way the traditional agriculture or whether we shall break away from that and to scientific and modern agriculture. This is the issue, the fertilizer and non-fertilizer (cow dung), the plant protection, non-plant protection. Some of us have been saying that we have been carrying on this agriculture for 2000 years and our peasants know everything in the world with reference to traditional agriculture but modern scientific agriculture is not known to every one of us. We have to learn many new things. Therefore, the policy decision with reference to the question is that we are not going to stick to traditional agriculture. We are going to turn to modern agriculture on the basis of modern material input, based on science and technology.'' (Hindu, 2001)

Since the start of the collaboration with IRRI in 1974, about 25 Indian scientists have served IRRI as international staff and 14 as members of the Board of Trustees. Dr. MS Swaminathan served as director general of IRRI from 1982-88. Indian scientists contributed significantly to IRRI's success and growth. Dr. GS Khush, rice breeder and World Food laureate made significant contribution to rice lines at IRRI. Over 1000 Indian researchers have participated in education and training programs at IRRI, whilst hundreds of Indian scientists have participated at IRRI's conferences, workshops and monitoring tours over the years.

The government of India has been contributing to IRRI's budget, building up from US$ 100,000 in 1982 to US$ 300,000 this current year. India's total contribution amounts to over $2m, while IRRI also offers research support funds to ICAR and state agricultural universities in India.

IRRI had also used Indian cultivars in its rice breeding programs and IRRI lines had been used extensively as parents in rice-breeding programs in India. The collaboration with IRRI in 1974 resulted in its receiving more than 15,000 rice accessions to the IRRI genebank. IRRI in turn has allowed India free access to all those from other countries in its genebank for crop improvement. More than 300 Indian rice varieties were developed using INGER (International Network for the Genetic Evaluation of Rice) lines, and have been released for commercial cultivation in India (see Table 8).

Table 8. Varieties/hybrids with an IRRI line		
VARIETIES/HYBRIDS WITH AN IRRI LINE AS ONE OF THE PARENTS RELEASED IN INDIA FROM 1966 - 2000		
Varieties/hybrids released in India	**Number**	**Most popular varieties/hybrids**
Elite lines directly released as varieties	50	IR20, IR36, IR64, Mahsuri, Sita, HKR 120, BR 2655-9-3-1, IR30864, Intan, Karjat 5, Sahyadri, Ponni (Mahsuri), ADT 37, Pantdhan 6, Pantdhan 4, Pantdhan 11
Inbred with IRRI line as one of the parents	256	CSR 23, CST 7-1, DRRH 2, Govind, KRH 2, Pusa 44-33, RH-204, Cottondora Sannalu, Shanti, Somasila, Surekha, Danteshwari, Poornima, GR 11, GR 4, HKR 126, Birsa Vikas Dhan 109, Birsa Vikas Dhan 110, Birsamati, Jyothi, Sweta, Gajapathi, Khandagiri, Kharveli, Jagabadhu, Lalat, Ramchandi, PR 106, PR 111, PR 113, PR 114, PR 115, PR 116, ADT (R) 45, ADT 32, ADT 36, ADT 39, ADT 43, ADT 44, CO 43, CO 47, CO 46, CORH-1, Paiyur 1, PMK 2, Pantdhan 10, Pant Sankar Dhan 1, Narendra Sankar Dhan 2, PHB 71
Hybrids	25	KRH 2, Sahyadri, PHB 71, PA 6201, Pusa RH 10, Narendra Usar Sankar Dhan 3

India-IRRI: Four Decades of Successful Partnership (New Delhi: IRRI, 2006) at p. 4.

The IRRI-India connection also produced hybrid rice, which ended by covering about 600,000 ha of agricultural land in India. According to IRRI, hybrid rice is 'poised for significant growth in the years ahead' (India-IRRI).

IRRI's particular brand of HYVs was to use improved and hybridized seeds with heavy chemical fertilizer, pesticide and water inputs, expand farming area and ensure double cropping. The major species used in India at the early stages was IR8, a breeding cross of Peta, a tall, vigorous variety from Indonesia, and DGWG (dee-geo-woo-gen) from China. In 1966, Dr. SK De, a young Indian agronomist at IRRI examined the fertiliser response of IR8 with other rice varieties and published his ‘yield response’ graph showing how yields of IR8 rose with increased fertilization while those of traditional varieties decline.

The new rice yielded bountifully, but was then found to have major disadvantages. It had an unattractive market appearance and high breakage during milling. But IRRI scientists believed the desperate need for food was sufficient reason to move ahead with IR8 without studying further impacts and the species thus became the prototype of the Green Revolution.

With the collaboration with IRRI and the advent of the Green Revolution of the early 1970s, rice production in India was reported to have risen steeply, by nearly 400 percent since independence from British rule. By 2004, production had risen to 124m tons from 54m tons in 1980. Within the first decade, from 1967-68 to 1977-78, the country was reported to have the status of one of the world’s leading agricultural nations. Reports in 1978-79 stated a record grain yield of 131 million tonnes, with yield per unit of farmland improved by more than 30 percent between independence and 1979.

The dramatic yield increase, and the subsequent overall effects and impacts of the Green Revolution were seen in the Punjab state of India.

Green Revolution, its early years in the Punjab

The rapid settlement of land claims after the partition of the state into what became Pakistan, and the completion of the consolidation of land holdings by peasant farmers by the end of the 1950s, created a favorable man-land ratio in the Punjab. The Land reform measures encouraged peasant farmers to invest in land improvement and adopt the new technologies of the Green Revolution.

Punjab was also a major beneficiary of British investment in irrigation works and development of canal colonies not executed in other States of India and commercialized by the British. In the post-Independence period, canal irrigation was further developed by the state, more particularly during the GR period. The availability of assured irrigation for fertile lands enabled a forward-looking peasantry to accept innovations in seed technology.

To promote investment at the farm level, arrangements were made for credit on long and short term crop loans through land mortgage, banks and a network of cooperative credit societies.

High-yielding dwarf varieties of wheat from the International Centre for Maize and Wheat Improvement (CIMMYT) in Mexico were first introduced. Several farmers already possessed the immediate capacity (supported by the government) to make the necessary investments in the new technology, easily imitated by other farmers, irrespective of the size of their holdings, when they observed the sudden jumps in per hectare yield. Between1965-66 and 1970-71 the per hectare yield of wheat doubled, from 1104 kg per hectare in 1965-66 to 2238 kg in 1970-71. Between1953-55 to1963-65, the index of agricultural production of all crops already experienced a growth rate of 4 percent compared to 2.2 percent at the all India-level. By 1960-61 the net sown area irrigated in Punjab had gone up to 54 percent.

Following the success of the new technology in wheat in the mid -1970s, a breakthrough was achieved in dwarf high-yielding varieties of paddy. Cropping intensity increased from 126 percent in 1960-62 to 185 percent in 1996-97, and the net sown area as a percentage of the geographical area rose from 75 to 85 during this period. The number of tractors rose from 10,646 in 1962-65 to 234,006 in 1990-93 and pumps sets from 45,900 to 721,220. Fertilizer (NPK) consumption increased from 30,060 tonnes in 1962-65 to 1,212,570 tonnes in 1990-93.

During the 1970s, national and state programs began releasing HYVs of their own, many of which were crossed with IRRI plant material. Of the 38 varieties of paddy developed and released during the mid-seventies, 23 of them had IRRI varieties in their parentage.

After wheat, paddy provided a major push to agricultural prosperity in the state. By the mid -1980s, except for the southern parts of Punjab, the state began to follow a' wheat-paddy rotation' pattern in cultivation, and, as a consequence Punjab became the food bowl of the country.

It became the largest contributor to the central pool of procurement of food grains both for food security, as well as for running the public distribution system of food grains. With the minimum support price for wheat and paddy combined with the procurement system of the union government, crop production was greatly supported.

Marginal land or forests in the Punjab have been cleared to make way for the expansion of agriculture; rotations have been abandoned; and cropland is now used to grow soil depleting crops year-in, year-out. Since the start of the Green Revolution, the area under wheat, for example, has nearly doubled and the area under rice has increased five-fold. During the same period, the area under legumes has been reduced by half. Today, 84 percent of the Punjab is under cultivation, as against 42 percent for India as a whole. Only four percent of the Punjab is now "forest", most of this being plantations of Eucalyptus. (Vandana Shiva)

The era also brought changes in lifestyle. Aspirations increased – there was demand for better education for children, better housing and better consumer goods. The traditional 'joint family' system was gradually replaced by the 'nuclear family'.

Supply of agricultural inputs at cheaper rates became a core demand. In order to relieve farmers from money lenders, co-operative societies and commercial banks were established in large numbers to provide agricultural credit to the farming community. As agriculture became modernized, electricity for agricultural purpose was required at cheap rates for long hours. Similarly, fertilizers and pesticides were also required to be supplied at cheap rates.

Green Revolution in Tamil Nadu

Another example of the Green Revolution, thousands of kilometers away from Punjab, is in the relatively poor North Arcot district in the southern Indian State of Tamil Nadu. Sixty-eight percent of farmers owned less than a hectare, though the majority in this district were owner-farmers, similar to Punjab. Paddy and groundnuts are the major producer crops in recent decades.

Though growth rates for paddy and groundnuts over the periods 1961-62 to 1984-85 were 1.47 percent and 1.04 percent respectively making it hardly a 'revolution' in the sense that Punjab was, the growth in paddy production was relatively dramatic, given the conditions. Between 1961-62 and 1984-85, paddy yields rose nearly 3 percent per year, attributable to high yielding varieties and high-inputs into soils. Paddy production increased by 60 percent during the period without increasing land-size, according to Hazell and Ramasamy (1991).

Irrigation and groundwater tubewells simultaneously increased during the rice increase period from 179,232 wells in 1965-66 to 301,116 in 1983-84. The number of mechanized electrical pumpsets doubled and by the mid 1980s, over half the wells were mechanized.

THE HIGH PRICE PAID TO GREEN REVOLUTION IN INDIA

India has paid a very high price for its thirty years of food increase through the Green Revolution's high-yielding varieties. Subsequently, the yield phenomenon declined. The reversal caused by the impact of external inputs on soil, water, environment and human health became evident. Today, thirty years after the euphoria, the country confronts an ecological and social crisis in its agrarian infrastructure.

Waterways have been polluted by the huge amounts of chemicals, soils depleted by chemical over-usage, agricultural workers poisoned by toxic chemicals, and beneficial biodiversity destroyed by this chemical onslaught. Yet, the impact on the lives of Indian farmers, as seen in the Punjab and Tamil Nadu, had been most staggering.

Yield increase was short-lived

The bumper yield seen in the earlier days of the Green Revolution was not sustained, seen in the case of Punjab.

Vandana Shiva made the following report in her book Violence of the Green Revolution.

"Soil deficiencies partly caused the decline in the productivity of wheat and rice in many districts in the Punjab, in spite of increasing levels of fertilizer application. The decline forced further fertilizer use in all GR farmlands. The seed-fertilizer package and its increased productivity involved, also, an increase in cropped area, a shift from mixtures of cereals and pulses to monocultures of wheat and rice and a change from crop rotation to multicropping of wheat and rice. This resulted in a rapid land-use change: croplands are now kept constantly under soil-depleting hybrid, chemical- intensive staples, rather than being rotated with soil-building crops like pulses and resulting in a break in the recycling of nutrients.

Soil-depletion in the Punjab is thus its dominant feature. Studies by the Punjab Agriculture University show that the physical output-input ratio from usage of NPK fertilizer has actually declined productivity, as compared to older non GR varieties, from 55 to 40 ratio for N, from 82 to 78 for P and from 165 to 78 for K with this shift to new GR seeds. As a result, there is stagnation in the response of crops to chemical fertilizer applications.

Crop failures at a large number of sites were reported in spite of NPK applications. The voracious, high-yielding varieties drew out the soil's micronutrients at a very rapid rate, creating deficiencies in zinc, iron, copper, manganese, magnesium, molybdenum, boron etc. Zinc deficiency is the most widespread of all deficiencies in Punjab currently. In recent surveys, over half of the 8706 soil samples from the Punjab exhibited zinc deficiency, reducing yields of rice, wheat and maize by up to 3.9 tonnes per hectare.

The Central Rice Research Institute of India (CRRI) summarized, in a publication titled 'Rice Research in India, an Overview' that: "the introduction of high yielding varieties has brought about a marked change in the status of insect pests like gall midge, brown planthopper, leaf folder, whore maggot etc. Most of the HYVs releases so far are susceptible to major pests with a crop loss of 30%-100%... Most of the HYVs are the derivatives of TN(1) or IR-8 and therefore have the dwarfing gene of dee-ge-woo-gen. The narrow genetic base has created alarming uniformity causing vulnerability to diseases and pests. Most of the released varieties are not suitable for typical uplands and lowlands which together constitute about 75% of the total rice area in the country."

Though chemical fertilizers and HYVs produced higher yields (20 percent) when first adopted in the 1970s, their yields have not increased much since then. Moreover, the yield differential between HYVs and improved local varieties diminished over the years as local research stations began incorporating additional features of HYVs into their own genetic material. The gross financial returns from paddy show little change when measured over the period. Paddy prices barely kept pace with inflation and the costs of production, particularly fertilizer, increased sufficiently to offset the gains made from higher yields. Costs for the farmer thus increased correspondingly.

Throughout India, chemical inputs increased exponentially to the point of over usage, with the advent of IRRI's IR8 and its sister varieties. Consumption of Nitrogen(N), Phosphorus (P) and Potassium (K) was highest in the southern States (Mishra, N. R. et al), followed by north, west and east India. Of the three, the use of nitrogen was highest because it was cheaper and came highly recommended, but consumption of P was again highest in the southern States followed by east, west and north India.

Soil erosion

Through chemical usage and on account of the extensive loss of vegetative cover as agriculture expanded into what were previously pasturelands and forested zones, soils suffer severe erosion in the process. According to one estimate, about 5,300 M metric tonnes of topsoil is being eroded countrywide annually, which is equivalent to about 12 tonnes/ha. Along with this topsoil, the loss of nitrogen, phosphorous and potassium ranges between 5.4mt – 8.4mt every year. Further, there is 1 – 2 percent loss of storage capacity in tanks and storage reservoirs due to silting. Depleted soils have led to degradation and loss of productivity in farmlands. Countrywide, degradation is put at 187mt/ha; degradation due to water erosion is about 148mt / hectare (57 percent), to wind erosion is about 13.5mt/ha (4.1 percent), chemical degradation is about 13.8 mt/ha and water-logging is about 11.6 mt/ha. The cumulative effect of this degradation of natural resources has led to even more exploitation of remaining natural resources in Indian agriculture (Dwarakinath).

Land use intensification took away the legume production and pastureland

The result of such agricultural intensification in the Punjab has been "a downward spiraling of agricultural land use - from legume to wheat to wasteland." The removal of legumes from cropping patterns, for example, has removed a major source of free nitrogen from the soil. (Vandana Shiva)

The loss of pasturelands is a serious problem that directly emerged from land degradation and expansion of agriculture. With over 60 percent of Indian farmers being small-holder relying on cattle for manuring and livelihood needs, the usurpation of grazing lands led to more land degradation with over-grazing. Moreover, fodder from rice straw for animals has decreased with HYVs producing higher ratio of grain to straw as against traditional varieties that produce four to five times as much straw. This resulted to severe loss of biomass availability for fodder and mulch. In addition, the new HYVs reduce the supply of fodder and organic fertilizer available to farmers. Traditional varieties of sorghum yield six pounds of straw per acre for every pound of grain; by contrast modern rice varieties produce equivalent amounts of grain and straw. This has contributed to the thirty-fold rise in fertilizer consumption in the state since the inception of the Green Revolution.

In a country like India, crops have traditionally been bred to produce not just food for humans, but fodder for animals and organic fertilizer for soils. In the breeding strategy for the Green Revolution, multiple uses of plant biomass seem to have been consciously sacrificed for a single use. An increase in the marketable output of grain has been achieved at the cost of a decrease in the biomass available for animals and soils from, for example, stems and leaves, and a decrease in ecosystem productivity due to the over-use of resources. (Vandana Shiva)

Water shortages

Along with soils, water was also adversely affected as indiscriminate deep tubewells were sunk throughout the country to sustain the irrigation needs of the new rice varieties. Groundwater levels, especially in southern India, have sank more in the last three decades than they have for centuries prior to that.

Traditionally, irrigation was only used in the Punjab as an insurance against crop failure in times of severe drought. The new seeds, however, need intensive irrigation as an essential input for crop yields. Although high-yielding varieties of wheat may yield over 40 per cent more than traditional varieties, they need about three times as much water. In terms of water use, therefore, they are less than half as productive. (Vandana Shiva)

Hence, in Punjab, large dams built for this water-need have spawned the problem of rising water-tables; it is estimated that an area of about 286,000,000 hectares of farmland in Punjab has a water table depth of less than 1.5 meters (Dwarakinath).

Intensive irrigation has also spawned conflicts between communities and between States. In the south, Karnataka and Tamil Nadu have been locked for years in dispute over sharing the waters of the river Cauvery; there are also smaller disputes still evolving over inter-State sharing of river waters for cultivation, between Andhra Pradesh and Karnataka, and Maharashtra and Karnataka. In the north, Haryana and Punjab have been at loggerheads over sharing the waters of the Bhakra dam, constructed for GR irrigation.

Hence, one result of the Green Revolution has been to create conflicts over diminishing water resources. Where crops are dependent on groundwater for irrigation, the water table is declining at an estimated rate of one-third to half a meter per year. A recent survey by the Punjab Directorate of Water Resources, has shown that 60 out of the 118 development blocks in the state cannot sustain any further increase in the number of tube wells (Vandana Shiva).

Diseases, pesticides and pests

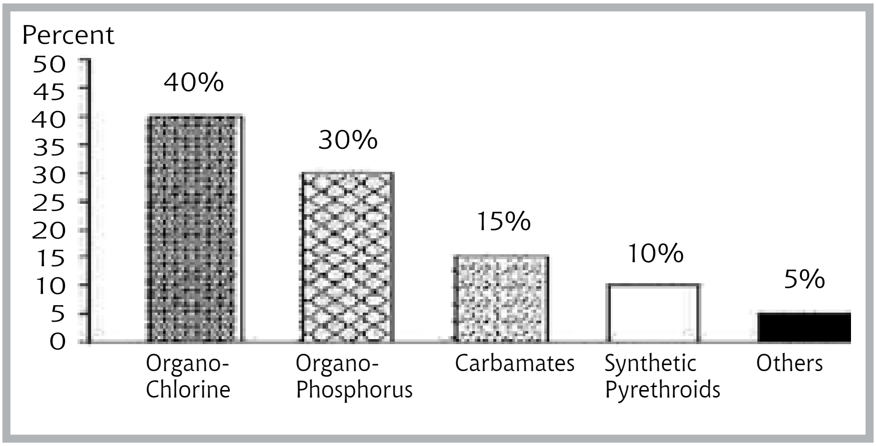
Because of their narrow genetic base, HYVs are inherently vulnerable to major pests and diseases. As the Central Rice Research Institute, in Cuttack, India, notes of rice: "The introduction of high yielding varieties has brought about a marked change in the status of insect pests like gall midge, brown planthopper, leaf-folder, whore maggot, etc. Most of the high-yielding varieties released so far are susceptible to major pests with a crop loss of 30 to 100 per cent." Even where new varieties are specially bred for resistance to disease, "breakdown in resistance can occur rapidly and in some instances replacement varieties may be required every three years or so." (Vandana Shiva)

Such that the new IRRI varieties have proved especially susceptible to pests and diseases. IR-8 was attacked by bacterial blight in southeast Asia in 1968-69, and was destroyed by the tungro virus in 1970-71. Subsequently, the new variety, IR-36 was developed with resistance to 8 known diseases and pests including those that attacked IR-8. This however, was attacked by newer viruses called 'ragged stunt' and 'wilted stunt'. In Punjab, a whole new genre of plant diseases cropped up with Taichung-1 which was infested with bacterial blight as well as the white-backed plant hopper. IR-8 then proved susceptible to stem rot and brown spot, in spite of their stated resistance to these.

Of the later varieties in Punjab, PR 106, currently accounting for 80 percent of cultivated area, has, in spite of being considered resistant to white-backed planthopper and stem rot disease, become susceptible to both as well as to rice leaf folder, hispa, stemborer and several other pests. (Dwarakinath). Rice cultivation in Punjab today is vulnerable to about 40 insects and 12 diseases.

From 1980 to 1990 alone, the area under pesticides in India increased 20-fold, from 6m hectares to 125m ha. In the early -90s, nearly 75,000 metric tonnes of pesticides were used annually (see Figure 1).

Figure 1. Consumption pattern of pesticides in India



Source: Safety Evaluation and Monitoring (1999)

The result of this heavy usage of pesticides, especially organochlorines which have proven links to human illnesses, has had a terrible effect on human health. A comprehensive study conducted in Muktsar district of Punjab by the Post Graduate Institute of Medical Education and Research, Chandigarh, had found strong evidence of the link between indiscriminate and excessive use of pesticides to the rise in number of cancers and cancer-deaths in the region (TERI).

The natural vulnerability of HYVs to pests has been exacerbated by other aspects of the Green Revolution package. Large-scale monoculture provides a large and often permanent niche for pests, turning minor diseases into epidemics; in addition, fertilizers have been found to lower plants' resistance to pests. The result has been a massive increase in the use of pesticides, in itself creating still further pest problems due to the emergence of pesticide-resistant pests and a reduction in the natural checks on pest populations. (Vandana Shiva)

Hence, without regulations and proper guidance on its disastrous consequences farmers have been using even banned chemicals in desperation at their pest-infested failing crops.

The issue of pesticides in India's groundwater and its seepage into the food chain was brought to national and government attention by the Centre for Science & Environment (CSE). In 2003, CSE brought out their findings on the high levels of residues and toxic pesticides commonly used in Indian farms, in coca-cola, tracing it to the groundwater used in their manufacturing plants in rural and semi-urban areas.

Loss of local varieties & biodiversity

Diversity is a central principle of traditional agriculture in the Punjab, as in the rest of India. Such diversity contributed to ecological stability, and hence to ecosystem productivity. The lower the diversity in an ecosystem, the higher its vulnerability to pests and disease. (Vandana Shiva)

The Green Revolution package has reduced genetic diversity at two levels. First, it replaced mixtures and rotations of crops like wheat, maize, millets, pulses and oil seeds with monocultures of wheat and rice. Second, the introduced wheat and rice varieties came from a very narrow genetic base. Of the thousands of dwarf varieties bred by Borlaug, only three were eventually used in the Green Revolution. On this narrow and alien genetic base the food supplies of millions are precariously perched. (Vandana Shiva).

The aggressive turning of all agricultural land into GR rice and other chemically induced crops has resulted in a tremendous loss of Indian biodiversity. The most frequently cited evidence for genetic erosion is indirect: the diffusion of modern, high-yielding varieties into areas once known for crop diversity (FAO Case Study, 2002). The MSSRF estimates that 300,000 traditional varieties have become extinct. IRRI says it has the genes of around only 100,000 of Asia's 500,000 varieties saved in its genebank. FAO estimates that as few as 12 varieties of rice may cover 75 percent of the fields in India (FAO).

A study of rice cultivation conducted in Maharastra by IDRC in one micro region, the Karjat Tribal Block revealed that cultivation of most of the indigenous varieties was given up following the introduction of HYVs. A set of 10-15 indigenous cultivars were replaced by 2 major HYVs, Ratna and Jaya. The survey considered this case study as indicative of the trend and extent of genetic erosion of rice crop in India.

In Jeypore, Orissa, one of the world's richest rice-diversity centers, the MSSRF managed to collect merely 324 rice varieties out of the 1,750 documented between1955-60. Of the 324, only 83 varieties were in cultivation in 1998. The study pins this loss on the introduction of high-yielding GR varieties along with canal irrigation facilities and the lower productivity of the traditional landraces. In Koraput district of Orissa, only 150 out of the documented 1750 varieties of rice remain today.

Other indigenous crops too have suffered all over India. In 1883, minor millet cultivation spread over 1,113 ha in the Namakkal region of Tamil Nadu as against 967 ha in 1996-97. In Waynad, a biodiversity hotspot in the Western Ghats of Kerala, there were 73 documented varieties of paddy, each with unique qualities. The FAO study in 2002 showed only 18 varieties left with their very existence under threat.

An estimated 95 percent of rice varieties in northeast India have disappeared. Throughout India, in fact, the loss of rice and local crops has been a shocking one.

Livestock diversity is also in serious problems associated with the lack of fodder and grazing lands with the GR. Under threat of extinction are 10 (50 percent) of India's goat breeds, 5 (almost 20 percent) of cattle breeds and 12 (30 percent) of the sheep breeds. The Ongole breed of cattle is now lost to India, now reportedly found only in Brazil from where it is being imported into India. The Nilgiri buffalo is endangered as are the Kadaknath hen and the Bonpalo and Nilgiri breeds of sheep. (Kothari, 1994).

Loss of traditional agricultural knowledge

In addition to the staggering loss of India's biodiversity, farmers in the main, with the exception of tribal communities, have forgotten their centuries-old agricultural traditions that helped sustain them over millennia. In the haste of the GR years, due attention was not paid to healthy farming practices, such as conserving, judicious utilization of natural resources, planning production and market sales and management. Farmers thus lost sight and memory of age-old practices and got no guidance on planning and marketing.

Green manuring, an ancient practice in rice cultivation, says Vandana Shiva, has been found to double the response to nitrogenous fertilisers. Green manuring combined with 60kg N/ha produced biomass of rice seedlings equal to that produced with 120kg N/ha.

Similarly, the age-old practice of applying farmyard manure has been shown by the Punjab Agricultural University to be more effective than chemical fertilisers. Applied at the rate of 12t/ha to rice in a rice-wheat system, increased the rice yield by 0.8 t /ha and when applied with 40 and 80 kg of N/ha, the increase in yield was 1.8 and 2.9t /ha respectively and compared to 2.76t/ha yield with 120 kg N/ha alone. (Vandana Shiva)

The GR replaced nitrogen-fixing crops like pulses which have an organic system of replenishing soils; millets which have yields from the perspective of returning organic matter to the soil was rejected. Biological products not sold on the market but used as internal inputs for maintaining soil fertility was neglected by the GR in their cost-benefit analyses. "They did not appear in the list of inputs because they were not purchased, and they did not appear as outputs because they were not sold," writes Shiva. (Vandana Shiva)

Traditional agriculture thus proved to be as efficacious as new agricultural systems, has thus been ignored. The loss of traditional knowledge transpired with the related loss in local seeds, their conservation, selection and development. Through the GR years, farmers looked only to the public sector hybrid seeds for their yields. And now, with these HYVs failing, farmers are now looking to private sector seeds to making an entrance into India through the newly-amended Indian Seed Act, which is tabled in Parliament. Having lost the knowledge of keeping their own seed, which was done through millennia, farmers are now looking for 'quickfixes'. (Acharya, 2006)

Thirty years of high-input chemicals and the initial high yields have engendered in farmers the mindset of high yields only, without seeing to sustainability of their soils. Today, with failing soils, high debts and poor yields, farmers are looking only for high-yielding seeds and damning the consequences.[4]

[4] Culled from personal site visits to four taluks in two districts of Karnataka. May 2006.

In the words of eminent scientist, Dr. R. H. Richharia (GRAIN, 1994), former director of the Madhya Pradesh Rice Research Institute, and one of the few persons within the establishment to oppose the entry of exotic rice varieties and have deep apprehensions on the chemical usage of HYVs:

> ***"The traditional agricultural systems and sciences as practiced in India and South East Asia have been to a great deal subverted in the past 25 years. The rice farmer, who has a proud history of plant breeding and scientific eco-specific cultivation, is today turned into a cog in the wheel of the agricultural sector where his fund of knowledge is considered only 'tradition'..."***

The system of one technology of IRRI-India hybrids for all agro-climatic and ecological regions of India, fertilizer, pesticides, irrigation, loan and marketing hopes displaced the ecological wealth, skills and self-esteem of many farmers. GRAIN, like many critics, pin the blame directly to IRRI's varieties.

> ***"The main agent of change was (and still is) the International Rice Research Institute (IRRI), which was charged with developing the new high-yielding, high external input varieties."*** (Genetech Preys on the Paddy Field. June 1998).

GR FAILED TO UPLIFT THE POOR FROM POVERTY

Green Revolution, especially where it was applied, only resulted in widening the gap between the rich and the poor in the rice growing areas of India. The benefit of high yield mainly redounded to those who have land and cash -- who could then afford to acquire the technology package, pay for irrigation, acquire the machinery, cope with the terms of credit, and survive and manage the challenges of agriculture. The impact on the small, especially landless farmers however were staggering, and FAO aptly describes it:

"Under-nutrition and poverty are still prevalent and the distribution of food remains skewed with families in landless, small-scale farming households and general laborers as high-risk groups. Studies of impact have shown that the better-off strata of rural society have gained access to better incomes generated by the introduction of technology whereas the poorest strata have tended to lose access to income that was available before its introduction ..." (FAO Focus, Women and Food Security)

Poorer, small farmers were most severely hit and most vulnerable in this technology, caught in a vicious cycle of trying to add more and more fertilizer in the hope of better returns and being faced with failed crops in return. In Andhra Pradesh and Karnataka, there were reports, during the 'cotton failure' suicides of the 2001 and onwards, that farmers, unable to pay the high costs of chemicals, were diluting their pesticides in a bid to make them last longer, causing even more pest-resistance.

Faced with depleted soils due to excessive and imbalanced use of chemicals that in turn have spawned newer diseases and pests' resistant to insecticides, farmers' distress are now widespread. Unable to pay their debts incurred from the cost of chemical inputs together with poor or failed productivity from depleted soils, farmers, especially in the southern States, have taken continuing recourse to suicide.

The financial daily Business Line (May 31, 2006) reports that from 1995-2003, 17 percent of farmers in Andhra Pradesh took their lives in despair, 20 percent in Karntaka and 14 percent in Kerala. Whilst it is generally known that the southern Indian States have had higher suicide rates, middle Indian States like Chatisgarh have also suffered.

Though these suicides may not be directly attributable to IRRI's varieties, the mindset of intensive chemicals and high yields that the GR pushed has been indirectly responsible for the overall mess in today's agriculture in India.

Poverty in the Punjab

In Punjab, which was the face of the GR's success that produced an entire generation of rural elite, falling yields from depleted soils have made farmers incur huge debts. In 2005, the total annual rural debt of the State exceeded its gross annual earnings from agriculture. According to the National Sample Survey Organisation (NSSO), each Punjab farmer has a debt of Rs. 41, 576 against the national average of Rs. 12,505.

Devinder Sharma gives the example of one village in Punjab, Malsinghwala in Mansa district which owes up to Rs 50m to banks and another Rs 25m to private moneylenders. With crops yields failing and no hope of repaying these debts, the village panchayat or village administrative body has now put the entire village's land, spread over 1,800 acres, up for sale. (www.countercurrents.org),

In December 2006, debt-ridden farmers in Vidarbha district of Maharashtra, the scene of terrible agrarian distress and suicides, offered their lands to Tata Motors for their car-manufacture unit. Tata Motors planned manufacturing unit at Singur in West Bengal is under continuing controversy and protests from farmers for usurping rich farmland.

Although the Green Revolution brought initial financial rewards to many farmers, especially the more prosperous ones, those rewards were closely linked to high subsidies and price support. Such support cannot be continued indefinitely and farmers in the Punjab are now facing, increasing indebtedness. Indeed, there is evidence of a decline in farmers' real income per hectare from 1978079 onwards. (Vandana Shiva)

The increased capital intensity in farming – in particular the need to purchase inputs – has generated new inequalities between those who could use the new technology profitably, and those for whom it turned into an instrument of dispossession. Small farmers – who make up nearly half of the farming population – have been particularly badly hit. A survey carried out between 1076 and 1978 indicates that small farmers' households were running into an annual average deficit of around 1500 rupees. Between 1970 and 1980, the number of small holdings in the Punjab declined by nearly a quarter due to their "economic non-viability". (Vandana Shiva)

The main lesson of GR

The mere introduction of a technology does not linearly redound to the promised food productivity for all; much less address the excruciating poverty of poor farmers. Rural poverty is a result of complex factors that result in the deprivation of the means and resources of production of vast groups in Indian society.

The efforts by policymakers however, gravitated to entrenching the GR agricultural model, while neglecting to address the causes of rural poverty in India. Nearly 43 percent of India's population live in dryland areas in nine States, Rajasthan, Madhya Pradesh, Maharastra, Gujarat, Chatisgarh, Jharkhand, Andhra Pradesh, Karnataka and Tamil Nadu. An entire belt of the population has thus been poorly served by appropriate responses and service delivery, with a host of problems confronting them, principally:

- Inability to source water for their small-holdings;
- Too poor to continue the trend of indiscriminate exploitation of groundwater that richer farmers have resorted to;
- Too poor to afford their own coarse grain cereals which have skyrocketed in prices as deep tubewell-irrigation lands turn to GR-method cash-crops and thereby endangering their own food and health security;
- Hunger thereby remaining at distressing levels;
- Their livestock facing starvation as fodder declines and they are unable to afford the expensive modern system of veterinary care, livelihoods thus even further endangered;
- In the face of such problems, becoming farm-hands in rich farmers' lands and being exploited in the process; or migrating to urban areas as equally exploited daily-waged labor, in industries such as construction or garment-making;

- Traditional societies are now breaking down in this process; inequalities intensifying;
- Landless labor still not even included in this GR debate; and
- Political rebel movements, like the 'Naxalites' were spawned in the face of such inequalities and poverty.

A FAO study says:

> ***"Under-nutrition and poverty are still prevalent and the distribution of food remains skewed with families in landless, small-scale farming households and general laborers as high-risk groups. Studies of impact have shown that the better-off strata of rural society have gained access to better incomes generated by the introduction of technology whereas the poorest strata have tended to lose access to income that was available before its introduction. This has led to the recognition by development agencies, including FAO, of the need to formulate a more equitable and sustainable Green revolution aimed at improving food security for the hard-core poor in rural areas. Much of the success of this new approach will depend on its ability to respond to the realities of the critical people involved in producing, providing and managing food supply within the poorest rural households - women farmers."*** (FAO Focus, Women and Food Security)

GENDER INEQUALITY

Other than being poor in dryland zones because one couldn't afford the expensive inputs of GR technology, women had been dealt particularly hard in this entire system, says the FAO, principally through:

- Increasing demands for cash for technological inputs;
- Thereby, increasing the need for unpaid female labor for farming tasks;
- Faced increasingly with working their chemically-degraded lands as more and more men folk migrate to urban areas in search of cash income as yields fail;

- All-round increase of women's work burden because of the poor scenario in rural India; and
- The negative status of women's health and nutrition as they face low or poor incomes, increased work burdens while still remaining caregivers.

NEW POLICIES STILL CAUSE CONCERN

The Indian government and IRRI have, only very indirectly, publicly admitted these huge failings and short-lived prosperity of the GR. In the Oct-Dec 2006 of the IRRI publication Rice Today, IRRI representative to India, Dr. J.K. Ladha says: "Right now productivity is maintained because farmers are putting in more chemical inputs. But I think it's just a matter of time – five, ten years down the road- and we'll really start to see the visible effects of land degradation." (Barclay, 2006).

IRRI is now assessing, under an ADB project, the potential of conservation agriculture in Punjab-Haryana, India's rice-wheat belt. Features of conservation agriculture, such as zero-tillage and direct seeding for saving, water, labor and money and suitable and reasonably-priced machinery for this is being thought of. The project hopes to change farmers' mindsets through this demonstration model.

But it sounds like too little, too late. This is inspite of IRRI's new strategy. The goals, which look fine at first glance, are to:

- Address poverty through improved and diversified rice-based systems;
- Ensure sustainable and stable rice production;
- Improve nutrition and health of poor rice consumers and farmers;
- Provide equitable access to information and knowledge and help develop the next generation of rice scientists; and
- Provide genetic information and material for improved technology and production.

However, the implementation of IRRI's new policies is again becoming controversial with IRRI's links to corporate interests. Especially controversial is its links with genetically modified 'golden rice'.

THE ENTRY OF GENETIC ENGINEERING

IRRI's collaboration with India on 'golden rice' comes at a time when India's government and scientists group are pinning their hopes on transgenic crops to alleviate the fall-outs of chemical over usage, decreased productivity and soil degradation that has now come from the 'Green Revolution' of the '70s. Prime Minister Manmohan Singh has termed the use of biotechnology in agriculture as the 'second green revolution'.

Meanwhile, concerned scientists and NGOs complain about the lack of public information on any dealings with genetically modified crops, while farmers remain desperate enough to try anything.

The 'golden rice' concept was first introduced into India by the Swiss through the Indo- Swiss collaboration on Biotechnology (ISCB) in 2000 at the request of Professor Ingo Potrykus of the ETH Centre, Zurich, the co-inventor of Golden Rice who was then on the Joint Apex Committee of ISCB. Until 2004, the Swiss Agency for Development Cooperation (SDC) and ISCB helped in linking India with golden rice scientists and stakeholders such as the Swiss MNC Syngenta, patent-holder of golden rice and numerous other rice lines, and in 'drawing up a concept for the safe and sustainable transfer to, and further development of, Golden Rice in India', according to Katharina Jenny of SDC, Berne.

SDC and ISCB terminated their Golden Rice program from 2004. India's department of biotechnology (DBT) though seems reluctant to even admit there was such a program in the first place.

Perhaps part of this reluctance stems from the disturbing concerns that the golden rice programme is still raising in India where it now continues as part of the Humanitarian Golden Rice Network with Dr. Ingo Potrykus, Syngenta and thirteen other members including the Rockefeller Foundation and IRRI. The research is centered in and being monitored from IRRI under what is now called the Humanitarian Board.

The Humanitarian Board has Syngenta providing the original genetic material royalty-free to public sector institutes and thereafter made available to subsistence farmers free of charge.

Syngenta, the patent-holder of nearly 70 rice accessions, has allowed only one variety, a Japanese one named Oryza sativa var krukoidee, to developing country researchers. Moreover, any additional strains developed during the research process are to be destroyed, thus leaving Syngenta with ultimate control over the method in developing the genetic material of 'golden rice'.

In India's case, this particular rice research is being conducted in national agricultural institutes. Whereas previously all GR research was in the public sector domain, this time, private corporate interests are using public sector scientists to develop a rice variety for a system that it owns and has ultimate control over.

According to rice scientists in India, who do not wish to be named, the science of golden rice itself is not revolutionary, but the product could still be of some significant use in the country. But India's rights over the product that India produces has not been clearly worked out by the government and it remains critical how issues such as royalty, licensing and distributing are handled by India.

Suman Sahai, Normal Borlaug Award winner and director of Gene Campaign questions if India should be growing this foreign rice when it remains the world's largest centre of rice diversity; whether public sector resources should be used for a product that is patented by a private corporation; whether public sector scientists should even be restricted in the manner of their research (Syngenta has stipulated the Agrobacterium method of genetic transformation), thereby losing their freedom.

Sahai also questions the appointment by Syngenta of Gerard Barry, previously from Monsanto, as the coordinator of 'golden rice' at IRRI. She writes: " It is ironic that the CGIAR, which claims to have more than 8,500 scientific staff on its rolls, could find no scientist of distinction to coordinate the Golden Rice program, if such coordination were indeed required and had to seek the help of Monsanto, for managing the Golden Rice research project!". (Sahai)

IRRI's entry into GM agriculture also coincides, as in previous GR years, with the Indian government's policies, in what seems like a desperate bid to amend today's agricultural crisis. India allowed the entry of private investment into agriculture by amending the Seeds Act, and pushed for transgenic crops as the best answer to India's current crisis. Most of the work being conducted is dogged by a lack of transparency, possibly because most of the research appears to be in private corporate hands, but this 'opaqueness' is in spite of democratically available mechanisms to access that information.

In spite of the Seed Act stating that farmers will be allowed to keep their own seed as long as they do not sell it, an aggressive corporate marketing push into farmers' fields leave the Indian small holder farmer probably worse off than before. The amendment also allows private corporations to deal directly with the farmer.

CORPORATE CONTROL OF SEEDS

Large multinational companies are now attracting Indian farmers through an aggressive extension network that promises seeds with bigger yields and better profits. And the desperate Indian farmer is now looking to private hybrids to fill in where public-sector hybrids are failing due to pests, diseases and failing soils.

Acquisitions of Indian companies by prominent agricultural corporations such as AgrEvo, Monsanto and Nunhems and their corresponding mergers in the global seed market has today made foreign corporate dominance in Indian agriculture a still-burgeoning phenomenon. Monsanto's recent acquisition of vegetable giant, the US-based Seminis Seeds has now made it the world's largest seed company.

One serious fall-out of this rapid dominance of proprietary seeds is the decline in public sector research and produce of seeds. The volume of public-bred hybrids came down to 38,704 tons in 1998-99 from 59,671 tons in 1990-91 while private investment in research simultaneously quadrupled between 1986 and 1998.

Instead, subsidiaries and joint ventures with multinational companies accounted for 30 percent of all private seed industry research till 2000. The larger Indian farmer is thus, though indirectly, entering the global commercial market through private-sector collaboration. The small Indian farmer continues to remain disadvantaged.

Furthermore, in 2006, India and the US embarked on a research collaboration named the US-India Knowledge Initiative on Agriculture. Universities and technical institutions and agricultural business will collaborate to provide 'environmentally sustainable, market-oriented agriculture'.

Under the agreement, India will pay most of the expenses, contributing about $US75 million over three years as compared to $24 million from the US. While the government will pay the Indian share, the US money will come from private companies and, according to laws governing US intellectual property rights, they will be the chief beneficiaries of research findings. Civil society organizations point out that MNCs will thus dictate and control Indian research, using the country's national intellectual capacity towards that end.

CONCLUSION

It could well be said that the Green Revolution, while definitely addressing the country's food needs, was unfortunately a very short-lived prosperity, suggesting it more as a 'stopgap' policy which left out an entire swathe of India's poor living in dryland areas and those unable to afford the expensive inputs it needed.

It was also sufficiently ad hoc to not have looked ahead in the long-term to assess the impact its high chemical and environmental resource consumption would have on India's ecology.

India's new policies continue to remain looking ad hoc in trying to stem the lack of yields that is now the result of the GR years, by proposing that agricultural needs be met through biotechnology research in private hands. Most of private sector research and agriculture now thus looks at profit-crops, leaving out rural poor in dryland zones because they do not offer gains.

The country now remains an anomaly: its economy on the service sector is rising while its agriculture now remains at a mere 25 percent of GDP. Yet agriculture provides employment to 55 percent of India's workforce, and livelihoods to two-thirds of its population, while continuing to be in distress, or shifting towards corporate control with the government seemingly unable to address its growth by its own means.

Corporate agriculture, in its turn, continues to be resource-consumptive and responsive only to those able to afford its inputs. India's rich-poor divide will thus probably become more entrenched than before; food security, nutrition and health for the poor continue to remain areas for serious concern.

Was the Green Revolution worth this? ■

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Pesticides and the Plight of Former IRRI Workers

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Pesticides and the Plight of Former IRRI Workers

Dr. Romeo F. Quijano and Sampaguita Q. Adapon

IRRI AND THE PURSUIT OF RICE

Rice is the most important agricultural commodity in the Philippines. It is a major staple, and accounts for 35 percent of the average calorie intake of the population and as much as 60-65 percent of the calorie intake of the households in the lowest income quartile (David and Balisacan, 1995; Tanzo, 2005). Rice farming is also the source of income and employment of 11.5 million farmers and family members. It contributes 13 percent to the Consumer Price Index (CPI), 16 percent to the Gross Value Added (GVA) of agriculture, and 3.5 percent to the Gross Domestic Product (GDP) (Gonzales, 1999). Due to its economic importance, rice has become the central focus of government agricultural policies (Sebastian, Alviola, & Francisco, 2000).

In cooperation with the Philippine government, the Ford and Rockefeller Foundations established the International Rice Research Institute (IRRI) in 1960. IRRI is an agricultural research and training organization located in Los Baños, Laguna. The institute's stated goals include reducing poverty through improved and diversified rice-based systems, and ensuring that rice production is sustainable and stable, has minimal negative environmental impact, and can cope with climate change (IRRI, 2006).

The institute has laboratories and training facilities built on a 252-hectare experimental farm on the main campus of the University of the Philippines Los Banos. IRRI employs hundreds of scientific and support staff, and as of November 2004, listed 720 Filipinos working at IRRI (IRRI, 2006b).

IRRI developed the first semi-dwarf rice in the mid-1960s. Pushed by international institutions, governments, and large agrochemical companies, the new grain varieties rapidly engulfed farming systems and triggered the so-called "Green Revolution" (IRRI, 2002). During this time, IRRI's researches and promotion of high-yielding varieties (HYVs) resulted in small farmers' intensive use of pesticides. In the Philippines, pesticide importation grew five-fold from 1972 to 1978 alone (Inq7, 2001a).

Over the years, rice scientists have incorporated elements of resistance to major insects and diseases in successive modern varieties (IRRI, 2002). In 2001, IRRI announced that a re-engineered variety of high-yield, pest resistant rice was ready for distribution to farmers. The New Plant Type (NPT), as it was called, was claimed to have substantially higher yield and supposedly needs fewer chemicals to protect it from pests and diseases (Inq7, 2001b). IRRI also claimed to have embarked on a campaign to reduce the use of pesticides in rice production, in the wake of studies that showed that the chemicals cause more damage than benefits. In a study by Pingali, Marquez, and Palis (1994), it was found that the positive production benefits of applying insecticides were exceeded by the increased health costs. The net benefits of applying insecticides were thus actually negative. Results of the study further showed that health costs incurred by farmers exposed to pesticides can reach up to 158 percent higher than those of farmers who are not exposed. As a result, at the IRRI's main experimental farm, IRRI claimed to have reduced pesticide use by 60 percent (IRRI, 2001).

However, the militant *Kilusang Magbubukid ng Pilipinas* (KMP), a Philippine farmers group with chapters all over the country, denounced IRRI for "hypocrisy" in its campaign against the use of pesticides in rice production. According to the KMP, the campaign was just a public relations strategy of biotech companies to generate public acceptance for genetically-engineered (GE) seeds and food in favor of gene giants and agrochemical transnational corporations (TNCs). IRRI further promotes genetically-engineered (GE) seeds, and relies on financing from industrialized countries and agrochemical transnational corporations (TNCs) like Monsanto of the US and Syngenta of Switzerland (Inq7, 2001a).

Another farmer group, the *Magsasaka at Siyentipiko para sa Pag-unlad ng Agrikultura* (MASIPAG) or Farmer Scientist Partnership for Agricultural Development, also believes that IRRI has not been successful in achieving food sufficiency in Asia. IRRI had wrought substantial changes on the Philippine agricultural landscape that were found very detrimental to small farmers.

Proof of this was echoed in a recent gathering of peasants, scientists, academics and professionals coming from Malaysia, Pakistan and the Philippines. IRRI was declared guilty of restructuring Asian farmers' sound traditional agricultural practices to become dependent and subjugated to chemical inputs that are products of transnational corporation-controlled agri-business. It was declared that IRRI's chemical dependent seeds and intensive capital input high-yielding varieties (HYVs) have continuously eroded the traditional rice varieties (TRVs) of Asian rice farmers, systematically destroyed the ecological system of agricultural lands, and put to great danger the life and health of farmers and peoples throughout Asia and the whole world. In addition, the IRRI was declared as having violated the rights of Philippine workers and peasants. IRRI had land grabbed some two hundred twenty-two (222) hectares of farmers' land in Laguna, Philippines. (Asian Peoples' Tribunal Against IRRI, 2006)

Because of this, farmers' groups have asked Philippine President Macapagal-Arroyo to abolish IRRI (Ponte, 2001). Farmer groups also urged the President to look carefully into the mandate of IRRI, especially its "immunity" from being accountable to any serious accidents or complaints from workers. According to Rafael Mariano from the KMP, IRRI has not been made accountable for the deaths of at least 215 former workers and other members of the community since 1975. Presidential Decree No.1620 gives IRRI a "diplomatic status" thus, its activities, whether in research or labor practices, could not be made to undergo litigation (Balana & Gaylican, 2001).

PESTICIDE USE IN IRRI

In a study conducted among eighty-eight (88) former IRRI workers (Quijano & Quijano, 2002), the workers identified several pesticides which they used during their period of employment at IRRI (see Table 9). These pesticides included organophosphates, organochlorines, N-methyl carbamates, and pyrethroids. For several years, IRRI used highly toxic pesticides such as endrin, endosulfan, monocrotophos, carbofuran, paraquat, methyl bromide, zinc phosphide, carbaryl, diazinon and triphenyltin, and exposed its workers to the various hazards that these pesticides bring. Endrin, which has been listed among the initial 12 persistent organic pollutants (POPs) targeted for global elimination or phase-out under the Stockholm Convention (UNEP, 2002), was used by IRRI even at a time when its extremely toxic properties were already known and developed countries have already begun to disallow its use.

Table 9. Pesticides Used at IRRI

The names of the pesticides mentioned by the respondents used at IRRI during the period of their employment include the following:	
ENDRIN (endrin)	HOPCIN (b-p-methylcarbamate)
AZODRIN (monocrotophos)	BASUDIN (diazinon)
FURADAN (carbofuran)	MACHETE (butachlor)
GRAMOXONE (paraquat)	THIODAN (endosulfan)
ROUND-UP (glyphosate)	BRODAN (chlorpyrifos)
HYTOX (isoprocarb)	BENLATE (benomyl)
2-4 D (2-4 D)	SEVIN (carbaryl)
METHYL BROMIDE	BRESTAN (triphenyltin)
DECIS (deltamethrin)	ZINOGAS (zinc phosphide)
MALATHION (malathion)	

Another extremely toxic pesticide, endosulfan, which is chemically related to endrin, was also being used by IRRI well into the 1990's when some countries have already banned or restricted its use, and years after the manufacturer of the chemical has been found guilty of submitting fraudulent toxicologic data to regulatory authorities (Quijano, 2000). Similarly, monocrotophos, carbofuran, paraquat, zinc phosphide, and methyl bromide, all Class I pesticides, were being used by IRRI even when it was obvious that conditions of use in the country do not allow any "safe use". While IRRI would declare later that they no longer use Class I pesticides in their research, they never acknowledged their mistake in using these kinds of pesticides for a long time during the so-called Green Revolution era. More significantly, they never acknowledged their responsibility in causing adverse health effects to the workers that they had deliberately exposed to such highly toxic pesticides.

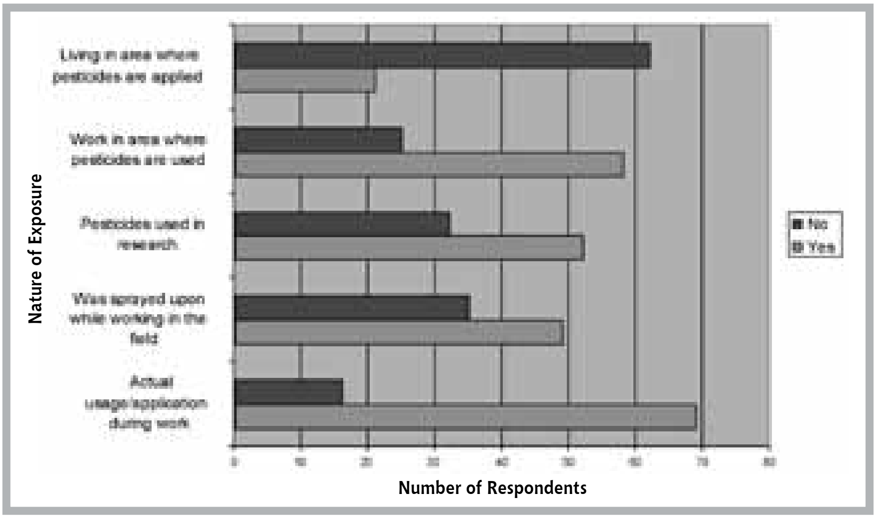
Despite its claim that it has been using the best available practices, IRRI has been using pesticides, such as glyphosate and butachlor, which have undergone very limited toxicologic screening tests and whose toxicologic data have almost exclusively been generated by the manufacturer itself (which explains the fact that the reports of clinical toxicity could not easily be extrapolated from the seemingly innocuous laboratory toxicologic data produced by the company). Worse, IRRI had been using the pesticide (butachlor) which was not registered for use in its country of origin (US).

UNSAFE PRACTICES

Being a well-known international agricultural research center, IRRI has always been perceived by governments and the general public as a responsible institution providing its workers the best conditions of work, compensation and benefits which supposedly even went beyond the minimum requirements set by national labor laws. Officials of IRRI have always claimed that they employed the best techniques and materials and that their workers were provided the best training and education on safety measures available at any given time. The results of Quijano and Quijano's (2002) study among IRRI workers, however, reveal otherwise.

While only 53 percent of the respondents were officially designated to work in the experimental farm, all of them, in fact, were at one time or another assigned to work in the experimental fields performing various tasks which directly exposed them to different kinds of pesticides. Seventy eight percent of the respondents' actually used or applied pesticides despite the fact that only seven percent were classified as pesticide applicators. The figure below shows the nature of exposure of the IRRI workers to pesticides.

Figure 2. Nature of IRRI Workers' Exposure to Pesticides



Contrary to the claims of IRRI officials, the former IRRI workers were not given adequate training and/or orientation with regards to safety precautions, particularly, with respect to pesticide use and exposure. A large portion (43 percent) of the respondents indicated that they were not given any training at all. The situation was even worse with respect to training and/or orientation on pesticide use. An overwhelming majority (64 percent - 69 percent) of the respondents indicated that they did not receive training and/or orientation on the topics shown (see Table 10).

Table 10. Training on Pesticide Use among IRRI Workers

Area of Training	Percentage of Respondents	
	Training Given	Training Not Given
Effect of pesticide and precautionary measure	33	64
Awareness and symptoms of chemical poisoning	28	68
Usage of personal protective outfit	39	58
First aid application in case of chemical poisoning	31	66
Things to do in case of pesticide-related accident	27	69
Safe storage of pesticide	27	69
Safe disposal of pesticide container/bottle/can	26	69
Safe usage/application of pesticide	32	65

Furthermore, the results also show that safety gadgets such as mask, respirator, eye goggles, gloves, etc., were not adequately provided for by IRRI and when available, were not used anyway most of the time. The former IRRI workers also indicated that the safety gadgets were made available only in the late 1980's. The poor practices of workers indicate their lack of training, as well as the inadequate safety procedures and equipment being provided to them during the period of their employment.

HEALTH EFFECTS OF PESTICIDE USE AMONG FORMER IRRI WORKERS

As may be expected from their exposure to pesticides, the majority (62 percent) of the respondents indicated various signs and symptoms that they frequently experienced during their work at IRRI (see Table 11). While a large percentage (46 percent) of the respondents also indicated that they were also exposed to pesticides during their previous jobs and in the household, these exposures were much less in number, amount, intrinsic hazards, and frequency compared to their exposure to pesticides at IRRI. It is also significant to note that 66 percent of the respondents revealed that they had suffered serious illnesses during the course of their employment at IRRI (see Table 12), and that they did not experience such illnesses prior to their employment at IRRI.

Moreover, the actual incidence of serious illnesses among the former IRRI workers is most likely greater than what has been captured by this study, since the mortality cases were not covered and since long-term effects such as cancer and other debilitating illnesses have not been fully accounted for among those who are still living. It would take lifetime monitoring to capture the real incidence of the long-term effects of their previous pesticide exposure at IRRI. Although the former IRRI workers could not attribute directly most of their illnesses to pesticide exposure, it is certain that exposure to various kinds of pesticides had something to do with the occurrence of many of these illnesses during their stay at IRRI.

Table 11. Signs and Symptoms Frequently Experienced by IRRI Workers

Subsequent to pesticide exposure in the field, 62 percent of the respondents reported ill effects of pesticides and/or chemicals. Complaints frequently mentioned include:

Severe headache	Muscle pain
Dizziness	Trembling
Skin rashes	Vomiting
Soggy eyes	Chest pain
Motion sickness	Cough
Numbness	Hyperacidity

Table 12. Serious Illnesses Experienced by IRRI Workers

Sixty-six percent (66 percent) of respondents claimed that they suffered serious illness in the course of their employment in IRRI. Among the illnesses mentioned were the following:

Abdominal cyst	Parkinson's disease
Accident	Pneumonia
Cataract	Scrotal cyst
Acute appendicitis	Blindness
Acute poisoning	Rheumatism
Bronchitis	Loss of hearing
Carpal tunnel syndrome	Schistosomiasis
Diabetes	Non-hodgkin's lymphoma
Pulmonary tuberculosis	Thyroid cyst
Severe diarrhea	Thyroid nodules
Paralysis	Typhoid fever
Influenza	Asthma
Gallbladder stones	Miscarriage
Heart ailment	Respiratory ailment
Hepatitis A	Kidney stones
Hepatitis B	Heart disease
Hypertension	Appendectomy
Kidney failure	Herniotomy
Inguinal hernia	Stiff hands and feet
Kidney infection	Tonsilitis
Mild stroke	Weak lungs

Considering the criteria for determining the association between exposure to pesticide and illness (Moses, 1999), it can be reasonably argued that exposure to various pesticides largely account for the illnesses observed among the former IRRI workers. Previous studies done by IRRI scientists themselves (Pingali, et al., 1994; Antle & Pingali, 1994) and other related studies worldwide show that increased pesticide exposure correlates with increased incidence of various types of illnesses (Igbedioh, 1991; Adler, 2003; Mills, 1998; Moses, 1999; Lang & Clutterbuck, 1991; Repetto & Baliga, 1997; Keifer, 1997; Dinham, 1993; Smolen, 1999; Guillette, et al. 1998). Furthermore, available animal studies clearly demonstrate that the pesticides used at IRRI cause different organ system abnormalities including, among others, brain disorders (Jones, et al., 1999), immune system dysfunction (Blakley, et al., 1999), endocrine system dysfunction (Rawlings, et al., 1998), reproductive disorders (Walsh, et al., 2000), congenital/developmental abnormalities (Miranda-Contreras, et al., 2005), liver and kidney problems (Khan, 2005), blood changes (Garg, et al., 2004), and cancer (Cabello, et al., 2001). Pesticides known to be genotoxic, embryotoxic, or endocrine disrupting were used at IRRI, and included the following: endrin, endosulfan, carbofuran, 2,4-D, deltamethrin, benomyl, chlorpyrifos, methyl bromide, zinc phosphide, paraquat, carbaryl, triphenyltin, and malathion.

There is also sufficient knowledge about the mechanism of toxicity of the pesticides used at IRRI and strong biological plausibility that the illnesses observed are the consequences of molecular events caused by exposure to such pesticides. The intrinsic hazard characteristics, the clear temporal relationship and empirical evidence, in addition to testimonial and physical evidence, show that pesticide exposure is the most likely cause of the high occurrence of illnesses among the former IRRI workers. The presence of confounding variables such as intake of medications, genetic predisposition, dietary factors, and previous exposure to pesticides constitute a very small contribution to the overall risk to the occurrence of the various illnesses observed. While smoking and the possible presence of other toxic substances may contribute to the incidence of certain illnesses, the overall picture would still point to the exposure to pesticides used at IRRI because of the much greater strength of association of the illnesses with pesticide exposure compared with smoking and possible exposure to other toxic chemicals.

It is also significant to note that about 23 percent of the respondents revealed having children born with abnormalities during their stay at IRRI. While the presence of other factors that could possibly cause the same abnormalities cannot be excluded, exposure to pesticides known to be embryotoxic, genotoxic, or endocrine disruptor is the most likely factor that could explain the high occurrence of such child abnormalities (Moses, 1999; Smolen, 1999).

HEALTH AND ECONOMIC COSTS OF PESTICIDES

While farmers were being exposed to the pesticides at IRRI, IRRI's scientists were at the same time conducting studies on the health and economic costs of pesticides. Their studies (Pingali et al. 1994; Antle & Pingali, 1994) have shown that the magnitude of health costs was directly related to pesticide exposure. Health costs were found to increase by 0.49 percent for every 1 percent increase in insecticide dose. At the time the study was done (1994), health costs on the average were 1,084 pesos when insecticides are not applied. For farmers who used a complete prophylactic application package consisting of calendar spraying, this requires approximately six recommended doses of insecticides per season, the health costs worked out to be 2,792 pesos on the average. Furthermore, when health effects were explicitly included, the net benefits of insecticide use were found to be negative. It was also established that pesticide-related health impairments caused significant reductions in labor productivity.

Pingali et al. (1994) have concluded that for rice production, when health costs are factored in, the natural control or "do nothing" option is actually the most profitable and useful pest control strategy. Antle and Pingali (1994) also concluded that there are likely to be social gains from a reduction in insecticide use in Philippine rice production. Reducing insecticide use was posited to have a small net effect on productivity because the productivity loss from reduced pest control would be mostly offset by the productivity gain from improved farmer health.

Other researches conducted at IRRI provide evidence that some pesticides may actually not be effective in targeting pests. Scientists have found that some pests actually had higher abundance in pesticide-sprayed plots than unsprayed plots. Moreover, in the sprayed plot, population size of those pest species increased following each insecticide application (Cohen, et al., 1994). Wu et al. (2001) found that some commonly used herbicides in rice fields actually had beneficial effects on the multiplication of the brown plant hopper, a serious rice pest. Furthermore, the resistance of rice to the brown plant hopper declined after some herbicide applications.

It is uncertain if these findings from IRRI-conducted researches were actually communicated to the farmers while they were working at IRRI. Farmers need to be given important information such as these, as it can help them make informed decisions. Given the questionable economic benefits and actual effectiveness of using pesticides, and the health costs of pesticides, a shift to more sustainable and less harmful methods of agriculture should have been advocated by IRRI. In fact, Quyen and Sharma (2003) have shown that rice can be grown organically with reasonable yield and substantial increase in grain quality and soil fertility. In evaluating the benefits of organic farming in rice agroecosystems in the Philippines, Mendoza (2004) found that organic farming utilized only 33 percent (39 USD/ha) of the cash capital to grow a hectare of rice when compared with conventional farm which spent 118 USD/ha. According to Mendoza (2004), the higher cash cost in the conventional farms was due mainly to agrochemical inputs, which accounted for 83.2 percent of the cash cost (fertilizer, 65 percent ; pesticides, 18.2 percent). In addition, the net revenue in organic farm (332 USD/ha) was higher than in the conventional farm (290 USD).

THE CONTINUING STRUGGLE

Former IRRI workers continue to experience the consequences of prolonged pesticide use during their stint at IRRI. In the 15th of September 2005, a member of the Brotherhood of IRRI Support Services Group (BISSIG) succumbed to a slow and painful death. Leoncio “Ka Leoncio” Mercado died at the age of 63 as a result of various illnesses such as kidney failure, acute arthritis, and tuberculosis and iron deficiency. He was bed-ridden for almost 6 months after his confinement in the hospital. Due to the high cost of medicines and laboratory examination, his bereaved family could not provide all the necessary medication since they have no constant source of income (RESIST TNCs, 2005). His brother, Aurelio "Ka Ure" Mercado, also a long time worker at IRRI, has had bouts of illnesses even when he was still working at IRRI and has recently been diagnosed to have liver cirrhosis.

Ka Leoncio and Ka Ure were among the 580 Filipino workers and farm-workers that were arbitrarily terminated by IRRI in 1997. BISSIG filed several cases against IRRI at the Department of Labor and Employment. Unfortunately, however, all cases against IRRI were dismissed not on merit but simply because of Presidential Decree 1620 (RESIST TNCs, 2005).

Like Ka Leoncio and Ka Ure, several other IRRI workers have already died of dreaded diseases or have been incapacitated by illnesses, including Parkinson's disease, liver ailment and kidney troubles, believed to be the consequence of exposure to chemicals and pesticides during their employment with IRRI. According to the former IRRI workers, the IRRI management did not even bother to look into these cases of death and illnesses. On the contrary, IRRI had consistently denied the fact that the pesticides which they required the workers to use had something to do with the occurrences of illnesses and death despite the fact that these pesticides were already known to cause such illnesses at the time that they were used at IRRI.

Outside IRRI, the effects of chemical and pesticide use are equally being experienced by the multitude of Filipino farmers who have been programmed to use these toxic chemicals and pesticides into the IRRI designed seeds and crops. In turn, the consuming public would have eaten these crops produced out of these toxics and poisons. This is a local and global scenario directly attributed to the IRRI program of toxics and poisons. ■

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Oryza Nirvana? Ten Years After... Perspectives on IRRI's Rice Breeding Program

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Oryza Nirvana? Ten Years After... Perspectives on IRRI's Rice Breeding Program

Wilhelmina R. Pelegrina

Dedicated to the memory of Ka Memong Patayan, Farmer-leader and SEARICE honorary board member who tirelessly questioned the relevance of the International Rice Research Institute.

THE PATH TO ORYZA NIRVANA

In 1997, SEARICE published "Oryza Nirvana? An NGO Review of the International Rice Research Institute", a report intended as an update for the NGO (non-government organization) community on the 'new IRRI' of the 1990s looking at IRRI's relevance to small holder farmers of Southeast Asia and its capacity to foster sustainable agriculture. In 1997, the report concluded that:

a) IRRI was a waste of money in terms of the funds it receives vis-à-vis its failure to achieve empowerment of farmers in research and in strengthening national research programs in a way that is meaningful to local communities.

b) IRRI's science is flawed in that it has not surpassed the yield potential of IR8 which was released in 1966 and in its reductionist approach for its subscription to genetic determinism theory to solve rice production problems.

c) IRRI is a pawn of the 1950's agenda of development producing aseptic scientific research environment coated with optimism and naiveté and its being donor driven.

d) IRRI undermines communities and their development, and stifles human resources in that it fosters dependency rather than self-reliance, and engages in proselytization over and above empowerment. It engages on centre-periphery relations which is very expensive and debilitating.

e) IRRI's approach is environmentally unsustainable where centralized breeding was seen as a conscious effort to introduce more risk, more vulnerability and more fragility in agriculture – an almost deliberate weakening process both in ecological and social terms.

According to the authors, Perlas and Vellve, none of these points of critique was new. The IRRI of the 1990's was not different from the IRRI of 1960's or early 1970's in the way it addressed the problems, issues and concerns of smallholder farmers of Southeast Asia. In terms of rice breeding efforts, Perlas and Vellve noted IRRI's new breeding agenda:

- Quest for hybrid and direct seeded rice – questions on effects on farmers' rice seed systems of hybrid rice and susceptibility to pests and diseases because of uniform maternal cytoplasm were questioned. For direct seeded rice, the authors recognized the efforts of IRRI but questioned the associated use of herbicides with direct seeding;
- Breeding for sustainability – which is limited to sustainability of immediate environment rather than communities and livelihoods;
- From ideotype to ideosystems or ideal, sustainable rice growing environment which Perlas and Vellve pointed as a step in the right direction, but is seen as short of answering the puzzle of sustainability from which breeding work should be context;
- Durable resistance – search for multiple resistance at the expense of other traits and diversity and the broader consideration of interactions in the ecosystem; and,
- Increased nutrient efficiency through the development of new plant types which Perlas and Vellve criticized for focusing on efficient use of chemical inputs.

Oryza Nirvana argued against the dominant science subscribed by IRRI; specifically, Perlas and Vellve also raised the limits of genetic determinism, where the success of IRRI's breeding for chemical responsive, nutrient efficient rice with internal pest resistance can be counterbalanced or even reversed by improper agronomic and soil fertility management approaches, and worse, by the financial capacity of farmers.

IRRI in the 1990's was seen as a born-again breeding operation, in that what it cannot attain through conventional breeding, it seeks to achieve through biotechnology. The first promised field application of IRRI's rice biotechnology in the 1990's was Bt rice. In response to criticism, IRRI announced that it would not use biotechnology to produce herbicide tolerant rice crops.

Ten years after the publication of this book, is IRRI's breeding program in the 21st century any different? This paper reviewed the Annual reports, publications and plans of IRRI from 1997 to present looking at the trends, shifts and changes undergone by IRRI in the past 10 years. This is intended as an update to civil society organizations on the status of IRRI's rice breeding program, 10 years after the publication of Oryza Nirvana.

TEN YEARS HENCE

This section provides an update on the breeding agenda identified by Perlas and Vellve in 1997. It provides a summary of what transpired in the course of ten years and what are some of the questions and standing issues to date.

Crop improvement or more technically germplasm improvement has been the core of IRRIs' work since 1960. IRRI's development of a high yielding semi-dwarf variety that is responsive to nitrogen fertilizer placed the institution on the map. In the 1970', where IRRI focused on introducing pest and disease resistance and improving the eating quality of irrigated inbred tropical rice. The work was strengthened by working with national agriculture research systems and the development of IRRI genebank. By the 1980's IRRI embarked on a breeding program for hybrid rice, rainfed lowlands, uplands, problem soils and the development of new plant types (IRRI).

New biotechnology tools in the 1980's such as anther culture and tissue culture accelerated the development of new breeding lines. By 1988, DNA marker technology accelerated conventional breeding through marker aided section. By 1991, IRRI had begun to use genetic engineering to introduce exotic genes and then transferred into different rice varieties (IRRI 1999, IRRI 1998, IRRI 1997). It was at this stage of IRRI's development that the discussions leading to the publication of Orzya Nirvana started. From 1997, what happened to the research direction identified by Perlas and Vellve?

HYBRID RICE RESEARCH, DEVELOPMENT AND COMMERCIALIZATION

In the past 10 years, IRRI continued its research on hybrid rice specifically the development of cytoplasmic male sterile (CMS) lines which are used by national agricultural research stations as one of the parents to produce the F1 seeds which are the ones provided to farmers for a 10-20 percent increase in grain production. In early 2000, there are two dominant CMS lines used in hybrid rice seed production in Southeast Asia, IR58025A and IR6282A.

The dominance of these two CMS lines was criticized by civil society groups (GRAIN 2005) as it makes for a narrow genetic base, which in practical terms means that if there is a single pest outbreak, Southeast Asian ricelands planted to hybrid rice can be wiped out. With the popularity of these two CMS lines in hybrid rice production, makes Southeast Asian food security vulnerable. This risk is recognized by IRRI as indicated by its pronounced commitment to develop other CMS lines.

IRRI may argue that the popularity of these two CMS lines is not their fault as their task is to provide the lines from which the national agricultural research stations can select from. As far as IRRI is concerned they have performed what they are mandated to do which is to provide materials freely to national agricultural research stations

(NARS). However, the initial success of NARS in hybrid rice production is a result of solid technical backstopping by IRRI. The Philippine Rice Research Institute's Mestizo hybrid rice is recognized as a product of IRRI's efforts.

In addition, does the technology development process stops at mere distribution of lines? Is monitoring of the performance of the lines they developed part of assessing the results and impacts of their research, which is an indicator of the relevance of IRRI? If so, then, IRRI should have some degree of technical responsibility in allowing for the limited use of CMS lines, knowing fully well the possible consequences. Part of sound science is providing technical advice to NARS.

The Asian Development Bank through a technical assistance fund, provided IRRI with US$1.4M for establishing an international network for the development and use of hybrid rice. The objectives were to (i) strengthen the capacity of national agricultural research systems (NARSs) from Bangladesh, India, Indonesia, Philippines, Sri Lanka and Vietnam for applied research so that they effectively use hybrid rice technology; and (ii) strengthen the hybrid seed production capacity of seed industries in India, Indonesia, Philippines and Vietnam to support increased rice production. The performance of IRRI, as the Executing Agency, according to the report of ADB is satisfactory. It provided a strong technical and administrative leadership to the network (ADB, 2002) IRRI provided more than 1,380 sets of parental lines and promising hybrids to network members for selection of improved materials. Why then were there only 2 ubiquitous paternal lines which dominated hybrid rice research in Southeast Asia?

In the Philippines, hybrid rice was moved into commercialization even when the seed production technology is not perfected yet under local conditions. There were reported cases of non-germination of F1 seeds and untimely flowering of parentals which affected seed production. Despite these imperfections, the government pumped prime the adaptation and use of hybrid rice by providing seed subsidies for farmers who want to use them.

In a separate study by SEARICE, it was found that substantial amount of funds for the program was possibly used as election campaign funds.

The recovered Marcos wealth, amounting to PhP 540M which by law is intended for agrarian reform beneficiaries, was used to finance the hybrid rice commercialization program at the expense of agrarian reform beneficiaries.

Neither PhilRice nor IRRI raised the technical soundness of this endeavor and the risks the government is taking with a technology which is premature in Philippine conditions. In this instance, hybrid rice through the hybrid rice commercialization program did not benefit smallholder farmers which are the intended clientele of both IRRI and PhilRice in its fight against hunger and poverty.

Admittedly, there were concerned scientists within IRRI and PhilRice who noted this hasty move by the Philippine government but they cannot speak in the open because it was a political decision. The usual official response was that PhilRice and IRRI are only mandated to look into the technical aspect of hybrid rice. Which is precisely the point – hybrid rice technology (which includes seed production) is still premature when it was commercialized in the Philippines.

The study of Janaiah and Hossain (2002) provided a good analysis on the social and political structures which allowed for the widespread adaptation of hybrid rice in China and the limitations posed in the Philippines. However, despite said research findings, IRRI as an institution remained quiet on the matter. The argument is that IRRI's responsibility was in the research and it is now up to the national research and extension system as well as the national government on how they will utilize the research results.

Where then is IRRI's social responsibility and scientific rigor if it allowed such misuse of hybrid rice technology? The whole research chain includes the actual application in farmers' fields and the contribution to the upliftment of the dire conditions of rice farmers - the reason for being of IRRI. How did IRRI fare on this, when it remained quiet, while the Philippines embarked on massive use of funds (tainted with corruption) to promote a not so perfected technology as hybrid rice in the Philippines?

It was through the ADB funds that IRRI with the FAO was able to successfully push NARCs to take on hybrid rice research and its subsequent commercialization as exemplified in the Philippine case. But having a hybrid rice program as in the Philippines taints this success. As the prime mover of hybrid rice technology research and application, IRRI cannot just stand and watch the technical follies and the misuse of funds in the Philippines' Hybrid Rice Commercialization Program. This is a disservice to the scientific community and the farmers at large.

There seems to be no change in the way and the path IRRI designed and advised NARS on hybrid rice program similar to the path taken in the 1960s, 70s: it was not able to address or correct the problems earlier pointed out by farmers on high amounts of inputs that needs to be applied to hybrid rice (similar to HYVs) which the farmers have been pointing out as problem of the modern varieties. IRRI is falling in the same pretext/ justification to what has been done to the Green Revolution of the 70s which is essentially placing the NARCs responsible for the implementation of the hybrid rice technology.

Another concern on hybrid rice, raised by Perlas and Vellve in 1997 is the possible loss of farmers' control in their local seed systems. If hybrid rice is planted in the next season, the population will segregate and will not yield as much as the F1 seeds. This is the reason, why farmers are encouraged to buy F1 seeds every cropping season. It is the same logic used in hybrid corn and in hybrid vegetables.

The introduction of hybrid rice changed the local seed system and there are concerns that hybrid rice technology will be an opening for companies to take more interest and control on rice seed production, thereby to ultimately integrate rice farming in their business. This will have consequences on food sovereignty where the production, sale, distribution of rice (the main staple in Asia) will be under the control of companies and not under farmers' own control (although current rice farming is under the control of local traders and millers, it is feared that the current situation will be aggravated with the entry of companies in the picture).

IRRI claimed among its milestones the development of tropical hybrid rice cultivars based on a diverse genetic-base being produced by an emerging private/public sector, and farmers producing hybrid-based crops are achieving approximately a 1 ton per hectare increase in their fields. (IRRI, 1998).

Before the introduction of hybrid rice, there was minimal interest of the private sector as it is seen as a not so profitable business. With the introduction of hybrid rice, companies were provided with a platform to enter into rice seed business. In the 2005-2006 budget hearing, the then Secretary of the Department of Agriculture - Philippines admitted that 60 percent of hybrid rice seeds is produced by one company, in contrast to previous years where the public sector was the main producer.

In China, which was growing hybrid rice for several years, private seed companies such as Origin Agritech, Bayer Crop Sciences have positioned themselves to cash in on big seed market (GRAIN 2007). This worries Chinese farmers as it endangers seed subsidies, possible increase in the price of seeds and the possibility of 'fake seeds' as companies compete with each other for profit (GRAIN 2007). What makes this alarming is that rice is the staple, cultural, political crop in Asia whose seed production has been at the hands of farmers for centuries. With the introduction of hybrid rice, this dynamic farmer system is threatened.

What is puzzling, is that the qualities of F1 seeds can be 'extracted' in subsequent generations, i.e., rice research institutions can tap the 'hybrid vigor' and stabilize this in later generations and release inbred rice like the usual varieties they release, without creating the complexities of introducing hybrid rice and ensuring that farmers will have equal access to grow and re-grow the seeds. PhilRice was successful in extracting lines which are the same if not superior to the F1 Mestizo line they released earlier. If so, what really is the motivation behind the research on F1 hybrid rice?

BREEDING FOR SUSTAINABILITY: DOUBLY GREEN REVOLUTION

There are efforts by IRRI to move towards sustainable farming with researches on sustainable production systems. In their budget spending and allocation, germplasm improvement (rice breeding included) accounts for only 25 percent of the total IRRI cost allocation (IRRI 2005), while sustainable production' in 2004 (and as projected until 2008) was at 35 percent . Budget wise, there appears to be a shift towards sustainable production than rice breeding per se.

In the report of the Director General for 2005-2006, Dr. Zeigler stressed that the 'institute should incorporate environmental considerations into its work in a sincere and fundamental way, not simply repackaging what IRRI is already doing' (IRRI, 2006 p.4). IRRI's interpretation of environmental sustainability is embodied in its Doubly Green Revolution launched in the Tokyo Conference in 2004, as part of the celebration of the International Year of Rice.

The context is that there is judicious use of chemicals; there is heavy dependence on the use of water and increase emission of greenhouse gases. In addition, continual and incremental increase in productivity is showing signs of slowing down. IRRI argues that increased productivity must be accompanied by environmental sustainability. Thus, the need for green and improved technologies such as raising the yield ceiling and bridging the yield gap in unfavorable environments.

Perlas and Vellve in 1997, as well as early critique of IRRI questioned the yield ceiling which was established by IR8 and which has yet to be surpassed. The yield gap, which is the difference between the yield at test stations and actual farmers' field, was an early concern of civil society groups which called for IRRI to address this more than raising the yield ceiling. Ten years after, yield ceiling and addressing the yield gap remain as objectives, but this time, repackaged for an IRRI that is responsive to the environment.

Other researches undertaken by IRRI for sustainable environment include:

- Developing genetic diversification approaches that will lower pest population – e.g. strip cropping with hybrid rice
- Developing ecology based and non chemical approaches to pests
- Alternate wetting and drying of the soil
- Developing aerobic rice
- Community led conservation of rice genetic resources

- Genetically engineered rice such as Xa 21 rice, Bt rice, high iron, and high zinc rice.

According to Gordon Conway, the basis for Doubly Green Revolution is sustainable agriculture, which was defined by Marcus Terentius Varro as far back as 2,300 years ago as an agricultural system which looks at productivity equitability, stability and resilience (GFAR 2006).

But let us look again at hybrid rice as a case for doubly green revolution. Hybrid rice poses a threat to the sustainability of farmers' seed systems, in which farmers are discouraged from re-using the seeds. Unless, farmers are trained to select from segregating population and to extract the good lines from hybrid rice, then can hybrid rice be part of a sustained effort but that will defeat the necessity to produce hybrid rice in the first place. In the end, is hybrid rice production the solution to increasing unproductivity of rice farms? And as mentioned earlier what is sustainable about government misuse of funds in the guise of promoting hybrid rice technology? What is sustainable about a more corporate form of agriculture, as exemplified by the growing corporate interest in hybrid rice production?

The efforts of IRRI to develop ecology based and non-chemical approaches to pests appear to be positive developments in the right direction. But non-chemical approaches to pests, gleaning at the publications of IRRI include the use of GE rice with pest resistance.

There are environmental and health concerns associated with the use of GE in food and agriculture which environmentalists will find incompatible with environmental sustainability. The approach of IRRI is to define environmental objectives and use either conventional and/or modern plant biotechnology to reach the objectives. Take aerobic rice development, which is an attempt to address scarce water resources, which is an environmental issue. But in order to develop aerobic rice, IRRI will either use conventional breeding, combined with marker assisted selections or will opt for rice transformations. Is GE aerobic rice, more environmental friendly than un-aerobic rice?

It appears that IRRI equates environmental sustainability with genetic engineering of rice. Is this what Dr. Ziegler calls for when he stressed that 'institute should incorporate environmental considerations into its work in a sincere and fundamental way, not simply repackaging what IRRI is already doing'? Is IRRI looking more at sustainable technologies rather than looking at sustainable systems?

On on-farm conservation point of view, the work of IRRI on community led conservation of rice genetic resources is a positive area. SEARICE which has been working on the area of on-farm conservation with farmers at the core, in different Southeast Asian countries have yet to see the models developed by IRRI on this. How widespread is the scope and coverage of on-farm conservation work of IRRI in Southeast Asia? How well prioritized is this work within the over-all IRRI agenda?

In addition, how can IRRI promulgate on-farm conservation at the same time work on hybrid rice and GE in rice when transgenes escape from cultivated GE rice to their weedy and wild relative through gene flow has become an indisputable fact (Chen et al., 2004)? Although IRRI, true to its promise is not working on herbicide resistant GE rice which is the case study in Chen's paper, the possibility of the transgene movement affects what the farmers are conserving, including wild rice relatives. Is this what the farmers want to conserve? The genetic integrity of wild rice, considered as endangered species, will be significantly affected with transgene movement.

FROM IDEOTYPES TO IDEOSYSTEMS OR IDEAL, SUSTAINABLE RICE GROWING ENVIRONMENT

Perlas and Vellve (1997) pointed this as a step in the right direction but were seen as short of answering the puzzle of sustainability from which breeding work should be context. Ten years after, IRRI continued to pursue researches on ideosystems through projects aimed at enhancing ecological sustainability and improving livelihoods through regional approaches to integrated natural resource management. This meant basically setting up models which demonstrates the use of systems approach like the model in Orissa, India where IRRI developed improved nursery management and crop establishment strategies along with integrated nutrient management with Sesbania, green manure, Azolla biofertilizers and water management strategies such as using marginally saline water for irrigation.

IRRI also embarked on researches which looks at enhancing water productivity in rice-based production systems such as alternate wetting and drying, similar to what proponents of the System of Rice Intensification (SRI) have been encouraging IRRI to study and promote.

Under a project on managing resources under intensive rice-based systems, IRRI also attempted to study the impact of interplanting different rice varieties on diseases, insect pests, and agronomic performance. In some rice farming communities, this is a traditional practice, how well IRRI will use the results of the study remains to be seen.

Part of IRRI's research on ideosystems is their research on drought. But their approach is primarily through the enhancement of germplasm for rainfed environments. The research also includes the production of aerobic rice both for rainfed and irrigated ricelands. The work on germplasm enhancement is linked to researches on water management strategies. How well, these linkage operates in practice will have to be observed.

DURABLE RESISTANCE

In the IRRI review of the 1990's, IRRI was in search for multiple resistance in rice. Perlas and Vellve worried that this is undertaken at the expense of other traits and diversity and the broader consideration of interactions in the ecosystem. After ten years, IRRI continued its research on resistance – among the achievements IRRI is proud to include its contribution to the growing understanding of the genetics of resistance to pests and diseases.

Other research outputs include lines derived from crosses of cultivated rice *(Oryza sativa)* with wild species *(Oryza longistaminata)* with increased tolerance of stem borer. There are also donor parents with increased resistance to sheath blight. Through marker assisted selection, researchers select plants that possess resistance genes (IRRI 2006B).

IRRI also use marker assisted selection to pyramid multiple genes for durable resistance to bacterial blight and blast. In 1999, 10 national research institutions in six countries worked with IRRI to intensify the application of biotechnology tools. The emphasis was on producing locally adapted high yielding rice varieties with durable resistance against diseases and insects and making them available to farmers. (ADB 2002; ADB 2003; ADB 2006).

Using genetic transformation, IRRI developed elite rice lines with Xa21 gene which confers resistance to bacterial blight and the Bt gene which confers resistance to stem borer (IRRI 2006B). IRRI also worked on blast resistance of elite temperate japonica lines adapted to the tropics. Transgenic CMS lines for hybrid rice production possessing the Xa21 gene or the Bt gene have also been developed.

There are debates within the scientific community on the merits of using genetic transformation in the breeding on the basis of health and environmental concerns. There is scientific evidence to show that transgene can move from transgenic rice to its weedy and wild relatives (Chen et al, 2004). For example, Bt gene which confers resistance to stem borer can also move to weedy rice (over several generations), which could contribute to the sturdiness of weedy rice, a problem in some Asian rice farms. Bt gene can also move to wild rice, considered as endangered further endangering the genetic integrity of wild rice, which in the first place is the one being conserved/threatened in situ.

Microbiota and enzymatic activities in paddy soil can be affected by Bt rice straw positively based on Xiang et al., (2004). But this needs further study especially over long term period to ascertain possible environmental impacts. There are also literatures pointing to possible effect (both positive and maybe negative) of transgenic crops on soil-plant associated microbial communities requiring further studies. Are these researchable areas investigated too by IRRI as part of their work on GE rice and biosafety?

In the end, does the research on breeding for durable resistance address the problem or will it create more problems with its use in farmers' fields? In addition, there are concerns from farmers on the release of GE rice in the open as potential contaminants especially in areas growing organic rice. International organic standards have clear guidelines against GM rice. The nobility of introducing good varieties and helping farmers to improve their productivity may in fact jeopardize their market for organic rice.

INCREASED NUTRIENT EFFICIENCY THROUGH NEW PLANT TYPES AND DEVELOPMENT OF C4 RICE

IRRI embarked researches not just in improving ecosystems but in developing new plant type cultivars using conventional and biotechnological approaches. Among its achievement is the development of new plant types with few tillers, sturdy culm, and heavy panicle with resistance to blast, bacterial leaf blight, tungro and brown plant hopper as part of increasing nutrient efficiency. Some plant breeders criticize this move of IRRI as the new plant type resembles that of traditional rice variety in a number of aspects. If any, the development of new plant type continues to typify the fixation of IRRI to incorporate in one plant, the best that rice breeding can offer with the aim of having a variety which will address all the major problems in rice production.

In addition, IRRI is working on developing a C4 rice plant for a more efficient and productive rice. C4 refers to the photosynthetic pathway (process of producing plant energy) of crops such as maize. It is said that C4 plants are more efficient in their photosynthetic process and yields well. IRRI aims to create a C4 rice plant with efficient radiation use efficiency approaching C4 plants for increased yield (Dawe, 1999). Genetic engineering is employed to create a C4 rice plant. This again leads to issues on the human and environmental risks associated with genetic engineering.

GOLDEN RICE: INCREASING NUTRIENT CONTENT OF RICE

Ten years after Oryza Nirvana, improving the nutrient content of rice through genetic engineering became a major interest of IRRI under its genetic enhancement for yield, grain quality and stress resistance project. In addition, under the Challenge Program HarvestPlus, IRRI is part of other research institutions breeding crops for better nutrition.

Specifically, IRRI provides the leadership for rice in this program which looks at the 'introduction of bio-fortified crops or varieties bred for increased mineral and vitamin content'.

IRRI rationalizes that bio-fortification will complement existing nutrition intervention and provide a sustainable low-cost way of reaching people with poor access to formal markets or health care systems' (HarvestPlus 2004). IRRI looks at bio-fortification as an additional strategy to supplementation, food fortification and dietary diversity. It argues that many cannot afford the dietary diversity, thus an option is to fortify the staple crop with vitamins and nutrients.

There are debates on the wisdom of fortification because it may encourage under consumption of a group of foods such as fruits, vegetables and cereal grains which may also contain unknown but valuable anti-disease agents and needed vitamins and minerals. In high dosages, some supplements, especially fat soluble vitamins such as Vitamin A, are dangerous. At low dosages, Vitamin A is necessary for health, but at high dosages it causes liver damage and can be fatal (Tansey and Worsley, 1995). Tansey and Worsley also points that dietary patterns alone, do not determine healthiness or disease.

Golden Rice is the pioneering work in the bio-fortification program of IRRI aimed at addressing Vitamin A deficiency. There is no approved nutritionally transgenic to date, according to Dr. Barry, the team leader of Harvest Plus Rice Crop Team (Barry, 2007). The high lysine maize product is being used as animal feed, Golden Rice if commercialized will be the first. Currently, there is no transformation work being undertaken at IRRI on Golden Rice. The work is now at breeding with the Golden Rice events crossed with adapted local varieties by IRRI and the National Agriculture Research Systems in the Philippines, India, Bangladesh, China and Vietnam. What IRRI and the NARES employs is to have some sort of shuttle breeding to allow at least one line to pass through the process, and with this line use to continue the work on Golden Rice despite safety, health and nutrition questions.

There are two Golden Rice materials developed by Syngenta as part of their commercial pipeline and which have been donated for use by the Golden Rice Network which are composed of IRRI, Philippine Rice

Research Institute, Cuu Long Delta Rice Research Institute (Vietnam), University of Freiburg (Germany), Department of Biotechnology India, Directorate of Rice Research (India), India Agricultural Research Institute, University of Delhi, Tamil Nadu Agricultural University, Bangladesh Rice Research Institute, Yunnan Academy of Agricultural Sciences (China), Agency for Agricultural Research and Development (Indonesia) including Syngenta and other private and public sector (Barry, 2007).

Currently there are:

- Three GR1 events
  - All single locus, single intact insert
  - Daffodil phytoene synthase (source of genes)
  - No selectable marker remaining
  - Carotenoid levels up to 8ug/g (field levels)

- Six GR2 events
  - All single locus, single intact insert
  - With sugar based, phosphomannose isomerase (PMI) marker
  - Maize phytoene synthase (source of genes)
  - Carotenoid level up to 25ug/g (greenhouse samples)

In the Philippines, the Philippine Rice Research Institute is crossing GR2 (IRRI is doing it for PhilRice) and GR1 with PSB Rc82. IRRI and PhilRice will decide this year whether there is sufficient backcrossing done to move to field testing.

GR1 attempts to address the concern of consumers on the negative health effects of using markers. There is growing scientific evidence on allergies and associated health effects with the use of markers. By avoiding the use of markers, IRRI softens the public concern.

With GR2, IRRI addressed the critique on the need to consume large amounts of rice in order to meet the daily recommended rate. GR2 has increased carotenoid level. But whether this carotenoid level will be converted into Vitamin A (bioavailability) remains a research area. In addition, the absorption rate in human body is another research area as human absorption of Vitamin A in affected by the presence of fats (being a fat soluble vitamin) and Vitamin D. Children who suffer from diarrhea due to dirty water and poor hygiene conditions will not be able to take up or retain nutrients like vitamin A from their food (Econexus, 2003). Bioavailability, both in terms of conversion rate and absorption rate remain as technical obstacles to the development of Golden Rice.

Another technical obstacle that IRRI scientists noted is that beta carotene (as indicated by the yellow coloration of grains) fades with storage. If IRRI intends to deliver Golden Rice to Vitamin A deficient locations, timely delivery will have to be addressed and the consumers will have to be educated on the loss of Vitamin A in storage. Families will have to consume the rice within specific time. This will be impractical in far flung communities which keep their own grains for a year's consumption and where there is limited transportation to ensure fresh supply of grains. Families will have to change their consumption patterns in order to get the best out of Golden Rice. Looking at grains supply, traders usually keep grains in warehouses for a season, what will be the advantage of Golden Rice if it will lose beta carotene in storage? What's the difference then of supplying Vitamin A rich vegetables to affected families? IRRI will therefore have to research the storage and delivery system in order to address this current weakness of the technology and/or improved on the longer term storability of beta carotene rice.

Among the lessons learned in Philippine Food Fortification Program is that fortification should not have an effect on the product. In the case of Golden Rice there are two products – the grains and the seeds. For the grains, Golden Rice is not a simple fortification of an end-product; beta carotene is embedded in the genes. Against a background of human body how will the genes behave? What will be the subsequent effects? These are areas of further research which IRRI needs to undertake to address health concerns.

In a speech by the President of India before the Global Forum on Agricultural Research in New Delhi last November 2006, he mentioned that the productivity of varieties have reached a plateau that is why there is a need to add nutrients as a form of crop improvement. Golden Rice was seen as an example of this. At the same time he recommended the need to capture the traditional knowledge of farmers as part of the second green revolution of the Doubly Green Revolution. But in the way, Golden Rice development proceeds, there was hardly any capturing of farmers' knowledge in addressing Vitamin A deficiency. If any Golden rice symbolizes 'application driven' science with a narrow, top-down approach (Econexus, 2003).

The problem is not a lack of foods containing vitamin A and beta-carotene, but a lack of access to these foods (Econexus, 2003; Barry 2007). Access to diverse diets does not translate to mere availability of seeds for planting as alluded by IRRI but also by the loss of knowledge about the relation between diet and health, and the consequences of eating only rice. The most effective international programmes targeting Vitamin A deficiency take into account cultural and economic considerations, with socially based strategies such as dietary diversification, schooling for girls and improved sanitation including promoting breast feeding, agricultural reform and food fortification (Econexus, 2003). Existing programmes of food fortification – without GM crops – show that vitamin A deficiency figures are already on the decline (Econexus, 2003).

Scientific evaluation also showed that the uptake of pro-vitamin A (beta-carotene) increased with the number of varieties of vegetable and fruit eaten by a person, independent of the quantity eaten (as cited by Econexus, 2003). IRRI through its Golden Rice addresses the issue as a single food nutrient, single plant approach. It has also restructured and backtracked on its promotion and argument by saying that Golden Rice will be complementary to existing work to address Vitamin A deficiency. The question then is, why do we have to single-mindedly focus on Golden Rice as a complementary strategy? Further, in developing complementary strategies. do we need to spend scant public research resources for such a single product development? Addressing malnutrition is a noble objective but is Golden Rice not a narrow path to solve the problem?

FARMERS' PARTICIPATION IN IRRI'S RICE BREEDING PROGRAM

Collegial participation of farmers' in IRRI's rice breeding program has been a long standing critique. Technology development process remains top down, especially now with the use of biotechnology tools.

According to an IRRI report, during the early 1960s and '70s, research focused on the on-station development of varieties which were passed on to government research and extension systems for dissemination to farmers. During this time, little adaptive research was done in collaboration with farmers; as a result some technologies were not adopted by farmers because they did not fit into the farmers' systems. Thus, research moved from the research station to farmers' fields, where the researchers managed the trials. In the end, the farmers' fields are used as mini-research stations controlled and managed by researches but reported as participatory research. In latter years, to augment this inadequacy, IRRI collaborated with some NGOs to cover for its top down approach in research.

IRRI still misses the point, the core argument is not just the delivery system but how farmers and their knowledge are treated as partners in rice research especially in crop improvement. It is evident from the research outputs of IRRI – Golden Rice, C4 rice – that the agenda were not driven by farmers out of their needs. Did farmers participate in identifying the breeding objectives, in selecting from early generation materials, late generation materials and adaptability trials?

This 'mind closure' comes despite developments in the field of participatory plant breeding (PPB) in Southeast Asia. IRRI argues that its varietal improvement program is aimed for national agriculture research stations and usually for wide adaptation in Southeast Asia, but what is worth pointing out is not the objective but the process in which varieties (and the breeding method) is developed. There are successes in the field of PPB in prime irrigated rice areas. SEARICE was able to model in a large scale the potentials of PPB in the Mekong Delta to complement institutional plant breeding. PPB works by enhancing farmers' inherent skills in selection and improvement for their own specific conditions and preferences. While most argues that PPB should be in marginal areas, SEARICE modeled in its work in Vietnam that it ought to be in prime irrigated areas where genetic erosion is more pronounced and farmers' knowledge and skills in selection are likewise 'eroded' as they relied more on breeding and seed institutions which are unable to develop and deliver good quality seeds on time and in volume.

It will still be a long way before IRRI truly accomplish full farmers' participation in research leading to an empowering process (in contrast to a patronizing process). With its thrust on genetic engineering/ development of GM rice, IRRI is further pushing farmers away from the research process and veering away from the realization of Farmers' Rights as enshrined in the ITPGRFA.

CONCLUSION

There have been a number of developments in rice breeding, 10 years after the publication of Oryza Nirvana. There were issues raised by Perlas and Vellve which IRRI attempted to address like more research on systems. But the dominant research direction diffuses these initiatives as IRRI upheld still its paradigm on scientific determinism and on single gene approach to complex problems. If any, IRRI has now shifted its gear towards hybrid rice technology and genetic engineering. Conventional breeding whose aim is to create diversity from which to select from is now being sidelined. There were no accompanying researches looking at effects of GE rice on systems. At the least, if IRRI's thrust has moved more to systems than germplasm improvement, then accompanying researches on the possible effects of improved germplasm (both for conventional and genetic engineering) on rice systems and human health be evaluated and studied. This area seems to be lacking in the new thrust of IRRI.

How relevant is IRRI now in rice farming with its current research direction/orientation? How much did IRRI contribute in the development of the current rice industry? How did an ordinary rice farmer fare in the past 10 years?

IRRI is at a crucial stage, where public funding for research is becoming scant and highly competitive. Within the CGIAR there are issues of rent seeking and donor driven agenda for the survival of institutions. Donor interest reflects national interest like the Japanese interest in IRRI's rice research (Alston, et al., 2006). In a study by Pardey et al., 1996 (as cited by Alston, et al., 2006), the US economy gained at least US$30M up to US$1B between 1970 and 1993 from the use of rice varieties developed by IRRI. This is relative to the contribution of the US amounting to around US$131M for the period. It is to the advantage of a donor to donate to IRRI. But this brings to question the research direction and the end beneficiary of IRRI's research.

Added to this complexity is the increasing role of the private sector. In a bid for more funding, the lines between private and pubic research in agriculture are becoming blurred (Alston, et al., 2006). In Golden Rice for example, has IRRI become a research arm of companies? Although it is intended for humanitarian goals, the companies are interested to commercialize the product in developed countries. With Bilateral Trade Agreements or in the case of US Public Law 480, where instead of directly providing loans, the US provide grains to a country and the sales from the grains will be used to finance the projects in the form of loans. Recently in the Philippines, in conversation with government officials, there seems to be move from US to provide GE rice to the Philippines under USPL480. Aside from impacting on local rice supply and price, if the Philippines got the GE rice, then at the end of the day, it will be the Filipino people who paid for the rice grown in the US. If Golden Rice becomes commercialized in the US, under a globalized trading system, the rice will still end up being consumed by developing countries paying still for the royalties on intellectual property protection either as direct product or as interest in loans. In the end, what did IRRI facilitated through its noble research objectives? How well did it serve small holder farmers?

IRRI is at a time when it should assess and redirect its research or else face the reality of its irrelevance and bring itself into a situation which justifies the call for its closure. ■

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Handing Over Farmers' Rice Wealth and Knowledge to the Gene Giants: An Analysis of Trends in Public-Private Partnerships in Rice Research and Development at the International Rice Research Institute

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Handing Over Farmers' Rice Wealth and Knowledge to the Gene Giants: An Analysis of Trends in Public-Private Partnerships in Rice Research and Development at the International Rice Research Institute[5]

Pedro Aurelio Z. dela Cruz

INTRODUCTION

The International Rice Research Institute (IRRI) in the Philippines is considered as the oldest and largest international agricultural rice research institute in the world. It is an autonomous, non-profit rice research and training organization with personnel in 14 rice producing and consuming countries in Asia and Africa. The Rockefeller and Ford Foundations in cooperation with the Philippine government were instrumental in the establishment of IRRI in 1960. Its avowed mission is to reduce poverty and hunger, improve the health of rice farmers and consumers, and ensure that rice production is environmentally sustainable through collaborative research partnerships, and the strengthening of national agricultural research and extension systems.

The avowed goals of IRRI today include: (a) poverty reduction through improved and diversified rice-based systems; (b) ensuring sustainability and stability of rice production, that it has minimal

[5] This paper was based on a research paper written, with the same title, by Ms. Elenita Daño as commissioned by PAN AP in 2004, and rewritten for this publication by Mr. Pedro Aurelio dela Cruz.

negative environmental impact, and can cope with climate change; (c) improvement of nutrition and health of poor rice farmers and consumers; (d) providing equitable access to information and knowledge on rice and helping the development of the next generation of rice scientists; and (e) providing rice scientists and producers with the genetic information and material they need to develop improved technologies and to enhance rice production.

Its first breakthrough was the development in the 1960s of high-yielding, short-stemmed rice varieties that sparked what became known as the Green Revolution in rice, that according to Food and Agriculture Organization (FAO), had saved millions of Asian population from famine, lifted more people out of poverty than at any other time in recorded history, and provided a platform for the region's subsequent economic growth.

IRRI serves as a model institute for a global network that make up the 15 nonprofit agricultural, forestry, and fishery research centers of the Consultative Group on International Agricultural Research (CGIAR). The CGIAR is a coordinating organization through which funds for international agricultural research are administered to the 15 centers.

CGIAR, chaired by the World Bank, is sponsored by the FAO, the International Fund for Agricultural Development (IFAD), the UN Development Programme (UNDP), and the World Bank. The CGIAR comprises 24 developing and 22 industrialized countries, 4 private foundations, and 13 regional and international organizations. An independent 8-member Science Council of leading scientists from developed and developing countries ensure that science in the CGIAR is of high quality and is relevant to the development goals of the System. IRRI receives its financial support from donor governments, agencies, and foundations – some of which comes through the CGIAR and some directly to the Institute.

The first International Year of Rice was declared by the UN in 1966, said to mark a turning point in rice history, with the launching of IR8 as the first in the long line of dwarf high-yielding varieties bred and released by IRRI. Celebrated as the first miracle rice, IR8 also signaled the beginning of the Green Revolution.

FAILURE OF THE GREEN REVOLUTION

Nearly four decades later, the world sees the distressing outcome of this corporate-led revolution to mankind's rice. Despite the leap in rice yields and production worldwide particularly in the earlier years, but miserably failed to generate rice sufficiency and security for rice-based societies.

As a result, Asian farmers lost their traditional rice varieties and related knowledge system. IRRI had replaced the self-reliant and developing traditional Asian rice agriculture to an input-dependent 'modern' type of agriculture. Poor rice farmers are seen as even poorer and hungrier than before, more mired in debt than ever.

Clearly, Green Revolution generated not jobs or purchasing power for the poor rice farmers who comprise the majority in rural areas, but super-profits for transnational corporations who turned the agricultural population worldwide as market for toxic agricultural chemicals they produce. After 30 years of the Green Revolution, the total revenues of the agrochemical industry were estimated at a staggering US$80 billion annually. (IRRI, 1995)

The industry spurred by the Green Revolution builds their riches to this day, and the foray is seen to be now in the area of modern biotechnology. Transnational agro-chemical and seed monopoly companies had merged and reemerged as giant biotechnology companies, dominating the so-called Life Industry. With the aid of genetic engineering, new seeds were brought to the market and the farmers' fields, staging the biggest stranglehold of agriculture by transnational corporations or TNCs in the modern era.

FLAWED RESEARCH FRAMEWORK AND THE GENE REVOLUTION

From the beginning, IRRI's operation centered on conducting basic research on the rice plant towards the vision laid down by its two major corporate foundations in increasing the quality and quantity of food crops available for the peoples of the world. Its research paradigm has remained largely reductionist and focused on increasing yields and production. Its research methodologies were largely scientist-centered, despite the shift towards so-called participatory approaches in the 90s. It was in fact the criticisms from farmers' organizations and civil society, as well as the pressures from the international donor community that led to the adoption of "participatory" mechanisms in IRRI's current research agenda. NGO critics had concluded that IRRI's activities and outputs are governed by a flawed ideology fostered by its founders, characterized by "Malthusianism, genetic determinism, science as a better solution than politics, technology as a tool for social change, and reductionism." (Clive James, 1997)

IRRI and the entire CGIAR have now shifted their sights on such visions as the Doubly Green Revolution and the Second Green Revolution. Instead of recognizing their responsibility in the damaging social and environmental consequences of the Green Revolution, they are now peddling the dreams of a Gene Revolution. These visions, by any name, promote the belief that genetic engineering, which follows the same reductionist paradigm that guided IRRI's Green Revolution research, will save the world from hunger.

PRIVATE-PUBLIC PARTNERSHIPS

The global framework of private-public partnerships

The development of public-private relationships of public research institutions and agricultural industries represented by agrochemical TNCs has been perceived largely to be influenced by issues of dwindling funds for the public research sector and technological advancements in genetic engineering. On one hand, most critical observers notice that beyond these issues lurks a far-reaching framework of control of agricultural resources by profit-motivated agro-corporations utilizing every avenue to pursue this end.

Agro-industry research reached high gear with genetic engineering development in the late 90s, motivated by the expansion of markets for this technology. But the cost of research has more than doubled, and industry wanted a mechanism to recover investment expenditures. It required an interfacing with public research institutions for the promotion and extension services to disseminate their biotechnology products.

In this frantic race by the industry to capture and safeguard biotechnology markets, they needed the tightening of intellectual property regulations, hence the establishment of the system through the Agreement on Trade-related intellectual property Rights (TRIPS) under the WTO. In this regard, private-public partnership expected a sharing and utilization of germplasms, and most importantly safeguard ownership through patent protection, and inversely have access and accommodation of requests for genetic resource for research purposes especially those under patent protection.

Thus, the international research institutions which brought the Green Revolution, play an important role in the TNC-led modern biotechnology incursions into the world's agriculture. There has been an increasing clamor to examine the evidences of an increasing trend in TNC alliances with international research centers and its umbrella, the CGIAR, in the face of the resounding rejection of genetic engineering in many parts of the world. The following discussion delves into the emerging trends and developments in public-private partnerships in rice research and development (R&D) that rice farmers and civil society across the world have to know, analyze and respond with concrete and appropriate action.

CGIAR and entry of TNCs

As early as 1998, as part of the recommendations from its Third System Review, the Consultative Group on International Agricultural Research (CGIAR) had urged the international agricultural research centers (IARCs) under its umbrella to enter into partnerships with the private sector to find solution to what it sees as a problem of seriously dwindling funds. Most of the IARCs then entered into various forms of partnerships with the private sector over the past five years, some "with small, local companies which affirm the centers' position as the majority partner in the collaboration", and the principal IARCs, with giant seed companies such as Monsanto and Syngenta. (IRRI Charter)

The CGIAR was established on 19 May 1971 by the Rockefeller and Ford Foundations (the same founders of IRRI) and the World Bank, as an informal association that supports agricultural research and related activities of an international public goods nature through autonomous international agricultural research centers specializing on the world's most valuable food crops such as rice, corn, wheat and root crops. In 1971, IRRI became one of the original four international agricultural research centers of CGIAR, as one focusing on rice, mainly in Asia which is the center of origin and diversity of the crop.

A closer scrutiny of its nature and evolution through the past three decades reveals that the CGIAR embraces private partnership for support. Private philanthropic organization members of CGIAR, i.e., the foundations, have been investing funds from the private sector into the network. The role of the private sector in the CGIAR became more clear-cut in recent years.

At its Annual General Meeting (AGM) in Manila in November 2002, the CGIAR formally accepted the application of the Syngenta Foundation for Sustainable Agriculture to be a member, in the midst of uproar from civil society organizations worldwide. Although receiving much less attention, the CGIAR has earlier acknowledged the Novartis Foundation for Sustainable Development as one of its partners.

CGIAR's acceptance of Syngenta Foundation was said to be premised in the latter's being a philanthropic organization and non-profit institution, and is totally independent from its mother company. However, the Foundation is exclusively financed by, and three of its Board of Directors are executives of the mother company.

The entry of the Syngenta Foundation into the CGIAR, in the context of the evident direction being taken by the international agricultural research centers towards genetic engineering, and coupled with the CGIAR's apathy to the contamination of traditional corn by genetically engineered corn in Mexico -- triggered the suspension by the NGO Committee of its relationship with the CGIAR in the AGM in Manila in 2002 (Spielman and von Grebmer, 2004).

The private sector committee in CGIAR

The PSC was created in 1995 with the chief executives of some of the world's leading seed and agrochemical TNCs in key developing countries, acting in their personal capacity, as its members. They include: the Maharashtra Hybrid Seeds Co. Ltd. (India), Pulsar Group (Mexico), Bayer AG (Germany), Monsanto Life Science Company (USA) and Pioneer Hi-Bred International, Inc. (USA). A representative of a global network of farmers' and producers' organizations, the International Federation of Agricultural Producers (IFAP) is also a current member of the PSC.

The mandate of the PSC is to provide the CGIAR with private sector perspectives on a range of issues on international agricultural research and to foster partnerships between private and public sectors towards a more holistic approach to global food security (Spielman and von Grebmer, 2004). The PSC had worked actively to further strengthen the grip of the private sector at the CGIAR, and lead it to the path of unequivocal support to genetic engineering R&D. The PSC does not at all hide its main interests in the CGIAR, which is the promotion of genetic engineering and proprietary sciences (particularly in relation to intellectual property) within CGIAR (Davinder Sharma, 2004).

In 1999, the PSC came out with the Tlaxcala Statement on Public/Private Sector Alliances in Agricultural Research: Opportunities, Mechanisms and Limits -- an initiative which involved several multinational firms, international organizations and CGIAR centers that provided a road map towards greater private sector cooperation and investment in agricultural research. The Statement recognizes that there is a great divide in terms of resources and cutting-edge technology in agricultural research between the private sector in industrialized countries and the public sector in most developing countries. It recognized that the expertise of the public sector remains in the conservation of genetic resources, basic research and germplasm while the strength of the private sector is in biotechnology and genomics, thus complementation of functions is expected to benefit agricultural research particularly in maize (corn), wheat and rice. It thus promotes the complementation of public and private sector initiatives in agricultural research mainly through prospective segmentation and specialization of their respective research efforts in terms of geographic areas, group of clients and type of products to eliminate this resource gap (Escaler, 2002).

The Tlaxcala Statement was reaffirmed by the Declaration of Corporate Support for Strengthening Cooperation Between the Private and Public Sector to Promote Agricultural Research and Agricultural Development as Catalyst of Growth and Sustainable Development, signed by the Chief Executive Officers of the world's biggest agro-chemical, seeds and agricultural biotechnology transnational corporations" (Fischer, 2000). The Declaration was signed by the top honchos of Mahyco (India), Merial Limited (UK), Emergent Genetics Ltd. (UK), BASF AG (US), Dow AgroScience (US), Seminis (Mexico), Syngenta (Switzerland), Cargill (US), Du Pont (US), Monsanto (US), and Bayer Crop Science (Germany) on 21 August 2002. The document, claimed by the industry as a concrete expression of its commitment to fostering partnerships toward sustainable development, also served as its lobby tool for the World Summit on Sustainable Development (WSSD) in Johannesburg the following month.

Private sector interest on the world's germplasm

The Tlaxcala Statement points to the germplasm which are mostly kept in public international and national genebanks (collected from farmers' fields and across diverse ecosystems all over the world, and not created by public research institutions) as an area of private and public sector R&D collaboration. The Tlaxcala Statement further says that the private sector counts on the basic and pre-breeding researches of the public sector as the means for the private sector to contribute to public R&D, and in reducing R&D costs of products and technologies. The document further reveals that the private sector relies on the cooperation of their public counterparts to provide an enabling environment for private sector investments in agriculture, particularly in the area of intellectual property rights and biosafety which are crucial policy areas in promoting genetic engineering.

The CGIAR funding crisis and inroads to the public-private partnership solution

The CGIAR has reported rough financial sailing over the past decade, saying that funding from its international donors was severely reduced by almost 50 percent from 1998 to 2003. The on-going funding crisis in the CGIAR reflects the overall declining support to public agricultural R&D globally, and growing private agricultural research, the latter growing twice as rapidly as public research in industrialized countries since 1981 (Johnson and Dryden, 2003).

This decline had also shown in CGIAR's reduced contribution to IARCs such including IRRI. In 2003, IRRI received 15 percent less from the previous year (IRRI Hotline and Archives, 2000).

This situation was used by the CGIAR to urge private and public sector collaboration in agricultural R&D, i.e., by its IARCs. The Third Systems Review of the CGIAR in 1997/1998 strongly recommended forging strategic alliances between public research institutions and the private sector to address the funding problems, and ensure complementation of each sector's strengths and assets[i]. This advice serves as the guiding framework for the CGIAR centers in striking partnerships with the private sector since the turn of the century.

On further analysis, it was rather the competition among businesses on what was touted as a level playing field in a global economy, which drove industries to stay afloat by investing resources on revenue earning ventures rather than on traditionally non-earning portfolios such as public R&D. Further, the adverse impact of the green revolution established a credibility crisis and the consequent worldwide protest to the chemical based technology package did not offer an attractive posture for donors to maintain their commitments to public research. This, and the financial crisis in the late 90's -- staged the platform for grant-funded research organizations to tinker with sustainability mechanisms, and forced large agro-corporations to a race to corner the billion-dollar agriculture market on a least-cost option, i.e., partnering with the now highly vulnerable public research sector.

Public goods posturing and private sector partnership

In 2000, Director General Cantrell stressed in an in-house publication that IRRI is firmly committed to the concept of international public goods being applied to all the results of the Institute's research, thus the institute did no research sponsored by the private sector or large companies (IRRI, 1994). Cantrell's statement was made at a time when IRRI has already gone through some collaborations with the private sector on projects that involve genetic engineering, particularly on Bt rice.

IRRI no longer denies its alliances with the giant companies. This, according to some IRRI officials however, does not sacrifice its goal of providing international public goods from rice research that are accessible to everybody. The latter serves even as its so-called moral imperative to generate additional funds from private sources to continue to provide public goods from its researches[ii]. He stressed that IRRI's main conditions in said collaborative relations is for such partnerships to remain non-exclusive, and for the products of such collaborations be made available to all, as elaborated in IRRI's Policy on Partnership with Private Sector.

A closer scrutiny of the principles and provisions of IRRI's Policy on Partnership with the Private Sector adopted by its Board of Trustees would reveal that the non-exclusiveness, transparency and access-to-all principles, are nowhere to be explicitly found in the written policy of the Institute. The non-exclusive principle applies particularly to breeding lines to be used by the private sector in hybrid rice development, but not in biotechnology-derived products or technologies. The memorandum of agreement with the private sector may be accessible to the public, but subject to confidentiality agreements and material transfer agreements. Its official policy states that IRRI is even amenable to entering into special agreements that provide some limitations on the distribution of the covered materials while it strives to retain non-restrictive access to the products of its research programs.

Further analysis of IRRI's policy in collaborating with the private sector reveals that IRRI does not only commit itself, its expertise and its facilities to private sector collaboration, but explicitly offers access to the national agricultural research systems (NARS) which have been working and collaborating with IRRI in different ways in rice research and development, i.e., IRRI then brokers partnerships of NARS with the private sector in rice research. (Please see related section on page 157).

Finally, biotechnology-based researches are pronounced to be consistent with IRRI's goal of sustainability and ecology-friendly technologies. That genetic engineering is such, is the claim made by the proponents of genetic engineering, in parrying the objections by farmers and consumers worldwide. To IRRI, therefore, there is no conflict with its mandate, much less a moral dilemma.

The following takes a closer look at the past, current and emerging partnerships and platforms for partnerships that IRRI has forged with the private sector, focusing on research and development in rice genetic resources as well as in the development of policy frameworks in the areas of intellectual property rights and plant variety protection.

IRRI-TNC PARTNERSHIPS IN BIOTECHNOLOGY RESEARCH PROJECTS

Case 1. Syngenta-IRRI Partnership on Golden Rice

The partnership was facilitated by a ploy by Syngenta (then Zeneca prior to a merger with Novartis) to give free research license on its Golden Rice, for so-called "humanitarian use", to public research institutions and governments in developing countries and to farmers with annual incomes of less than US$10,000[iii]. Syngenta sub-licensed these proprietary rights for humanitarian use to the inventors but retained all rights to explore commercial prospects for the technology. The license includes the rights to improvements and to share regulatory data with Syngenta.

The so-called Golden Rice is a rice strain that has been genetically engineered to express beta-carotene, which the human body then converts to Vitamin A through complex interaction with other nutrients and fats. The beta-carotene gene that was manipulated into the rice genome originated from the yellow flower, daffodil. The developers of the Golden Rice reasoned that since rice naturally lacks Vitamin A and blindness is a common result of deficiency of this particular nutrient especially among children, genetically engineering rice with beta-carotene would be a logical solution to address this problem. The research rationale was widely criticized for its reductionist approach that misses the fact that blindness due to malnutrition is not only a result of Vitamin A deficiency but a direct consequence of lack of access to nutritious food caused by poverty.

The delivery of Golden Rice from the developers' laboratories in Europe was made possible by the "donation" of intellectual property licenses from the companies that own patents on the processes, gene constructs and gene sequences involved in the development of the final product, namely, Syngenta Seeds AG, Syngenta Ltd, Bayer AG, Monsanto Company Inc., Orynova BV, and Zeneca Mogen BV. Each company has agreed to extend free license to their respective patented technology used in the research that led to the Golden Rice invention. Subject to further research, initially in the major rice-growing developing countries in Asia, as well as compliance with local regulatory requirements, the Golden Rice can then be made available free-of-charge for humanitarian use in any developing nation (Manicad, 1999).

The first free research license was awarded to IRRI which received the first shipment of the celebrated Golden Rice seeds in January 2001. IRRI was also granted the right to sub-license the technology to other public institutions in developing countries that wish to do further research on the Golden Rice, namely the NARS. Licenses have so far been given to five major rice growing countries in Asia, namely Philippines, India, China, Vietnam and Indonesia (Manicad, 1999). Syngenta and the inventors had to directly grant a license to Vietnam since IRRI refused to extend a sub-license due to the absence of national biosafety regulations in that country.

"Donating research licenses for patented technologies" was a ploy used by both Monsanto and Syngenta. Syngenta's stunt was preceded by its main competitor, Monsanto, when a few months earlier in August 2000, it announced at an agricultural biotechnology symposium in India that it would provide royalty-free licenses for all of its technologies that can help the further development of Golden Rice and other pro-vitamin A enhanced rice varieties.

While Golden Rice is still in its advanced research and development stage both in laboratories in the North and the South particularly at IRRI, Syngenta already owns registered trademarks on the product. Long before the final product ever hits the market, which is not expected in the next five years, it has already been tagged as Golden Rice Pobey and Carat Golden Rice by the world's biggest agribusiness giant. (Biotechnology Global Update, 2000). The trademark, of course, is Syngenta's effort to lay legal proprietary claim over the invention ahead of the pack.

To manage the further development and future distribution of the Golden Rice, the Golden Rice Humanitarian Board, was established in 2001. The Board is composed of the original Swiss and German inventors, Syngenta, World Bank, and Rockefeller Foundation which provided most of the funds for the development of the Golden Rice; and representatives of agricultural institutions from the South, including IRRI. Its aim was to smoothen the path in relation to intellectual property by the private sector: "to manage transactions costs arising from efforts to disentangle the complex web of intellectual property ownership associated with key technologies, and a lack of ex ante good-faith agreements over the use of private-sector intellectual property used by the original academic researchers" (Perlas and Vellve, 1997).

Syngenta's monopoly arch-rival, Monsanto, earlier established its own Global Vitamin A Partnership in March 1999 together with the World Health Organisation (WHO) and United Nations International Children's Fund (UNICEF) after the company has developed a technology to increase levels of beta-carotene in oils which it wanted to share with researchers in the developing world. (Perlas and Vellve, 1997)

IRRI had even appointed a former Monsanto executive as the coordinator of its Golden Rice Network, the in-house coordinating mechanism of IRRI's involvement in Golden Rice. Dr. Gerard Barry, the former head of Rice Genomics and former Director of Research for Product and Technology Cooperation at Monsanto, was hired by IRRI in late 2003 to specifically "facilitate the development and deployment" of the genetically modified Golden Rice in key rice-growing countries in Asia (Pardey and Bientema, 2001). IRRI's Golden Rice project is funded by the United States Agency for International Development (USAID).

IRRI-Syngenta partnership is touted as a model of public-private partnership in agricultural research avowedly motivated by purely humanitarian goals. This façade however does not hide the fact that IRRI and other public research institutions take care of the R&D and later distribution of the genetically engineered product to poor farmers in developing countries, their private partners commercialize the same product in expanding markets for "healthy" foods in developed countries. The arrangement also tasks Syngenta to provide regulatory, advisory and research expertise to assist in making Golden Rice readily available to developing nations.[iv]

This façade poorly hides the fact that the terms of the humanitarian arrangement are dictated by the patent owners and IRRI. As IRRI's multi-awarded chief plant breeder, Dr. Gurdev Khush admitted, the Institute's right to develop tropical versions of the beta carotene-rich rice "hinges on the decision of 32 holders of 70 patents to donate their intellectual property rights to make Golden Rice freely available to people making less than US$10,000 per year".[v]

Case 2: IRRI-Biotech Companies' Partnership on Bt Rice

One of IRRI's earlier forays in public-private partnership on modern biotechnology -- involved the development of Bt rice, separately with three private biotechnology companies.

In 1988, IRRI and the Belgian plant biotechnology company Plant Genetics Systems (PGS) began a two-year project on the isolation, identification and characterization of natural Bt strains with potentially useful activities in rice pests. (The soil microorganism Bacillus thuringiensis or Bt possesses a gene that expresses a toxin which have been found to be fatal to Lepidopteran insects, a family that includes the yellow stem borer, considered a pest in rice; since the 1950s, the natural spore form of Bt has been widely used worldwide as an organic insecticide.) The project, which involved the collection of thousands of strains of natural Bt from across Asia, was supported by the Rockefeller Foundation. PGS boasts of a library of 12,000 Bt strains from across the world, the first patent on genetically engineered Bt tobacco and a controversial broad-spectrum US patent on all plants containing the Bt gene.[vi] The company was later bought by the agricultural transnational AgrEvo.

The IRRI-PGS partnership agreement included provisions on exploitation rights of the resulting technology, which granted exclusive rights for industrialized countries and non-exclusive rights for developing countries to PGS, while bestowing non-exclusive rights for developing countries to IRRI.[vii] As part of the project with PGS, IRRI personnel received training at PGS' laboratories in Ghent. While PGS' interest on the project was on potentially viable strains of Bt that it can apply on various crops, IRRI's rights were focused on useful Bt strains that it can engineer into rice. After two years of collecting thousands of natural Bt strains from various ecosystems, the initial project did not yield further partnerships on the development of Bt rice.

IRRI picked up on this initiative with two other biotechnology companies that have developed their own synthetic versions of the Bt toxin gene. The first partnership involved the Swiss agro-chemical company Novartis which provided IRRI with its synthetic version of the cry1a gene of the soil bacterium Bt free of charge for application on rice. The agreement stated that the resulting Bt rice will be made available to all countries, except in most industrialized countries.

At about the same time, together with a consortium of national agricultural research centers from across Asia, IRRI directly purchased the rights to a technology from the Asian Rice Biotechnology Network (ARBN) -- the synthetic cry1A toxin gene from Bt developed and patented by Plantech, a Japanese company involved in plant genetic engineering. Largely through IRRI's expertise and advanced molecular facilities, with the collaboration of some advanced national research institutes, the ARBN hoped that Plantech's Bt gene will be engineered into the rice plant to produce varieties that are resistant to the yellow stem borer. Under the direct-purchase agreement with Plantech, the consortium maintained the right to commercialize the end-product from the application of the technology on rice to later decide whether to make these materials public property or allow others to use the technology, subject to royalty payment" (PD 1620, 1979).

The ARBN was initiated by IRRI in 1993 to provide technical support and training to national agricultural research and extension systems (NARES) on biotechnology tools to solve problems affecting rice production. The network received funding from the Asian Development Bank (ADB) and the German development agency, BMZ from its inception until it folded up in 2002, and is composed of national institutions from China, India, Indonesia, Philippines, Thailand and Vietnam. The activities of the ARBN revolve around the training of national researchers on rice biotechnology and the development and release of improved varieties using conventional breeding.

IRRI started its efforts in inserting Plantech's and Novartis' Bt gene construct on tropical rice varieties in 1994, amidst biosafety concerns raised by Philippine civil society organisations on the transboundary movement of genetically modified organisms (GMOs) in the absence of national guidelines. The Philippine's Biosafety Guidelines at the time only covered contained experiments on GMOs, and did not provide for comprehensive regulations on the transboundary movement of GMOs. The controversy reached the Philippine Congress which conducted a series of congressional inquiries on the matter in 1996.

IRRI later started the open field trials of its Bt rice in China in 1998, after Thailand turned down IRRI's request to host the trials. Thailand's National Center for Genetic Engineering and Biotechnology (NCGEB) cited the expected negative repercussions of releasing genetically engineered Bt rice in open fields on the country's prime export niche in the international rice market (CGIAR, 1998).

The partnership with Plantech specifically did not mature since the Bt gene construct procured by ARBN from the company turned out to be ineffective after being engineered into tropical rice. Public and private researchers in China, however, continue with their large-scale field trials of their own version of Bt rice which are reportedly successful and expected to be commercialized in two to three years' time. Researchers from public institutes in Iran also claimed to have successfully developed and field tested their own Bt rice using the cry1A gene construct that the Agricultural Biotechnology Research Institute of Iran (ABII) has secured from IRRI (Plant Physiology, 2000).

The Bt technology in rice has been put to serious questions from the time the public learned about IRRI's efforts in developing Bt rice. It was another clear manifestation of IRRI's (and other national agricultural research centers' similar research on Bt rice) top-down approach in setting the rice research agenda. While yellow stem borer is considered a problem in many rice-growing areas throughout Asia, it was never considered as serious as other more damaging pests in the rice plant, such as the tungro virus. Single-pest solutions, such as the Bt technology, also failed to address the fundamental conditions that brought about pest infestation in Green Revolution areas, namely monocropping and the massive use of chemical pesticides that all the more trigger pest outbreaks.

PROMOTING MODERN BIOTECHNOLOGY THROUGH POLICY AND LOBBY

While IRRI remains to be influential in the policy-making processes at the national and international levels, it alone cannot effectively address broad policy issues that have direct bearing on the private sector's interests in rice research. Thus, it needed the NARS, government agencies and the wide network of public and private institutions working with IRRI – a vast and influential web of institutions to effectively push for specific positions and framework in policies related to intellectual property rights, biosafety and even incentives for private sector investments in agricultural R&D in general.

IRRI lobby through CORRA on PVP

One broad network of NARES in Asia that IRRI pushed to lead the advocacy on rice related policies in the past decade is the Council for Partnership on Rice Research in Asia (CORRA). The network was established in 1996 to become a policy study instrument for policy issues that run across the existing partnership mechanisms for rice research in Asia. Through the years, the umbrella has evolved from internal discussions of partnership issues in rice research to outright influencing of policies in rice research and the rice industry in the region (Cantrell, 2002).

In 2000, CORRA aimed its sights at facilitating the passage of a UPOV type of plant varietal protection laws in Asian countries. The UPOV, originally established in 1961 and dominated in membership by industrialized countries, is an international instrument that bestows intellectual property rights to commercial plant breeders on new plant varieties, and limits farmers' traditional rights to save, use and share their seeds. It has adopted two Conventions, namely the 1978 and the 1991 versions. The 1991 UPOV Convention, in comparison with the 1978 version, offers a wider scope of rights to commercial plant breeders and more limitations to farmers' rights.

The network organized an international conference at IRRI on the subject in 2000, attended by representatives from the private sector, intellectual property rights experts, farmers' organizations and non-government organizations from all over the world. The conference concluded that there is a need for the international and national agricultural research systems to prepare "proper laws on plant variety protection and intellectual property". to address the concern that existing legislations may restrict the free exchange of genetic materials needed by scientists to develop new higher yielding rice varieties, in most Asian contexts where the concept of ownership in the rice industry is alien.

As a result, the NARES members were prodded to actively lobby their respective governments to adopt "proper" national laws. Two years after the celebrated CORRA conference on plant variety protection, Indonesia and the Philippines, whose NARES are part of the founding members of the consortium, adopted in 2002 their respective PVP laws. Vietnam followed in early 2004 with its own plant variety protection ordinance. These PVP laws adopted by the Philippines, Indonesia and Vietnam also encourage private sector investments in seed development.

Fostering private-public collaboration on biotechnology R&D through ABSP

IRRI is a member of the Agricultural Biotechnology Support Program (ABSP), established and funded by the United States Agency for International Development (USAID). The consortium "supports the development of expertise in target countries in the areas of research, policy development, licensing, and outreach, to help reduce poverty and hunger through agricultural biotechnology" (Spielman and Grebmer). ABSP is implemented by a consortium of public and private sector institutions, coordinated by Cornell University in the US. The program maintains four regional centers that coordinate project activities in the target regions, namely in South Asia, Southeast Asia, West Africa and Central Africa. The Southeast Asia Center is situated at the Institute of Plant Breeding (IPB) at the University of the Philippines in Los Baños (UPLB), next door to IRRI.

ABSP is now on its second phase, which focuses on the "safe and effective development and commercialization of bio-engineered crops as a complement to traditional and organic agricultural approaches in developing countries" (SEARICE, 2002). The project claims to help boost food security, economic growth, nutrition and environmental quality in East and West Africa and in Indonesia, India, Bangladesh and the Philippines.

An important component of ABSP's function is to facilitate partnerships between the private sector and public research institutions. Two of the better-known examples of ABSP's initiatives in public-private partnerships took place in Egypt and Indonesia. The partnership between the Agricultural Genetic Engineering Institute (AGERI) in Egypt and the US-based company Pioneer Hi-Bred involved the application of the Bt technology on maize where the Bt strain was developed by AGERI and licensed to Pioneer. A similar collaboration between ICI Seeds (now owned by Syngenta) and the Central Research Institute for Food Crops (CRIFC) in Indonesia on the development of Bt maize was made possible by ABSP with USAID funding.

ABSP is composed of an impressive array of national government agencies dealing with policy formulation, national agricultural research institutions, international research centers, and regional bodies, US universities, national and transnational seed companies, and policy lobby groups. A closer scrutiny would reveal that it is a potentially effective and powerful web of institutions, organizations and companies that could push USAID's paradigm and policy positions on agricultural biotechnology.

THE IMMINENT THREAT: THE PLUNDER OF RICE GERMPLASM FOR GENETIC ENGINEERING

The more than 100,000 rice collections at IRRI constitute a substantial bulk of the 600,000 accessions kept under ex situ conditions at the centers under the CGIAR umbrella -- kept in trust for world community under a Convention on Biological Diversity (CBD) regulated agreement between the CGIAR and FAO. While the CGIAR's collection constitutes only about 15 percent of the estimated 3.8 million crop samples stored ex situ worldwide, largely by the public sector, that rich germplasm pool is considered to represent about 40 percent of the unique food crop germplasm (UBINIG). Access to this invaluable asset makes it clearly attractive for the private sector to collaborate with the CGIAR centers which have custody over these rich germplasm collections like IRRI.

The IRRI gene bank (now officially called the International Rice Genebank Collection) presently holds more than 100,000 varieties of rice germplasm collected from farming communities and various ecosystems across the rice-growing areas of the world, the bulk of which were collected from the known centres of origin and diversity of rice in South, Southeast and East Asia. Apart from the ex situ rice collections, IRRI also has in its custody an impressive documentation of rice-related knowledge and practices held by rice farmers from all over the world. Its more than 40 years of research on the biological, ecological, socio-cultural and economic aspects of rice farming has allowed IRRI to accumulate a comprehensive understanding of rice knowledge systems. Confirmed by the Tlaxcala Statement, this too, constitutes an invaluable asset that the private sector would have interest to access since traditional knowledge and practices of farmers on particular crops and plants are known to have facilitated R&D of products with potential commercial value.

The Asian farmers had indicted IRRI for the high level robbery it committed of the world's rice germplasm and the displacement of this traditional wealth of agriculture by a few varieties that deliver super-profits for TNCs. IRRI began to stage the plunder of world's rice wealth for Green Revolution in the 60s, and for over 35 years of collection and research across diverse rice ecosystems throughout the rice-growing areas of the world, reports in its custody a genebank of some 85,000 rice germplasm accessions.

It should be known that the original 1959 MOU that established IRRI did not refer to the collection of rice germplasm as part of its objectives. Neither was this found in the 1960 Articles of Incorporation that served as basis for IRRI's legal registration in the Philippines. It was only in the October 1982 revision of the Articles of Incorporation that IRRI wrote its mandate to "establish, maintain and operate a rice genetics research laboratory which will make available to scientists and institutions all over the world a global collection of rice germplasm" (CGIAR Private Sector Committee, 2004).

The 1995 IRRI Charter further clarified the Institute's mandate to maintain a rice genebank collection by explicitly stating that IRRI aims to "maintain a rice genetic resources centre which will collect, store and make available to scientists and institutions (both those in the public and private sectors) all over the world rice germplasm and related genetic materials" (CGIAR Private Sector Committee, 1999). Hence, IRRI had committed international fraudulence by collecting rice germplasm even prior to any international mandate. The Convention on Biological Diversity (CBD) in 1993, explicitly provides that States have sovereign rights over the biological resources found within their respective territories.

Custodianship issue

To address the legal limbo surrounding the invaluable pre-CBD germplasm collections, the FAO and the CGIAR entered into a "trust agreement" in 1994 assigning trusteeship of this enormous wealth of humanity in the hands of the FAO. The physical custodianship of this massive collection of ex-situ plant genetic resources, however, remains with the CGIAR centres that maintain the genebanks where the germplasm are kept, namely IRRI in the case of rice. The custodianship arrangement was further reinforced, but with broader decision-making mechanisms involving member-states, in the provisions of the FAO's International Treaty on Plant Genetic Resources for Food and Agriculture adopted by countries in November 2001.

Opening the germplasm wealth to TNC appropriation

Despite the custodianship arrangement with FAO, the CGIAR and IRRI officials had expressed that the ex situ rice genetic resources kept in the genebank and farmers' knowledge as the major assets that the international agricultural research centres can bring into partnerships with the private sector (IRRI, 2001). IRRI maintains that the bulk of the rice germplasm that it has under its custody is part of the public domain anyway that even corporations can freely access, as the FAO-CGIAR Trust Agreement provides. There was no set limit either on how much germplasm or farmers' knowledge that IRRI keeps which will be made accessible to its partners in the private sector.

While IRRI officially adopts a policy that it will not protect the rice genetic resources it holds in trust "by any form of intellectual property rights" and is opposed to the application of patent legislation to plant genetic resources (genome-types and/or genes) held in trust, this however, does not extend to improved germplasm derived from materials held in trust, especially those that were developed through biotechnology.

INFLUENCING THE NARS THROUGH IRRI

Through IRRI, TNCs are able to tap the National Agricultural Research Systems or NARS. The Golden Rice project of Syngenta tapped on IRRI to sub-license the technology to the NARS in Asia who in developing the technology in tropical rice. IRRI also maximized its vast network among the NARS in its foray with Bt rice where the Bt gene sequences from Plantech and Novartis.

IRRI maintains very strong relationships with the advanced NARS in India, China and Indonesia – all important emerging markets in Asia. This strong ties with the NARS, many of which are part of the numerous networks that IRRI established through the years for various purposes, is another invaluable asset that IRRI opens to TNCs through partnerships with the private sector. The vast network of NARS, many of which work directly with farming communities in research and extension services, has intimate knowledge of pathways for local market access, applied breeding skills and infrastructure, understanding of the seed delivery and extension systems, and access to local genetic resources. These knowledge, skills and resources in the hands of the NARS, which IRRI does not possess, are invaluable to companies seeking to expand their market reach to new potentially profitable areas.

IRRI's influencing the NARS however, poses a threat to determining research priorities of a nation. As in the Philippine case, the flagship research of biotechnology pushed research towards hybrid rice and biotech crops development, farther away from sustainable agriculture and farmer-based research concerns.

FARMER-BASED RESEARCH: AN ALTERNATIVE APPROACH TO IRRI

Rice farmers have for thousands of years been the stewards of the rice seeds, nurturing and developing them to what has become now the premier and staple crop of more than half of the nations of the world.

Rice, as a highly regarded crop, can spell the bane or doom of the economy of a rice producing nation, thus, placing it to a status of being a highly political crop. Up to now, many countries, subsistence economies and indigenous peoples in Asia regard rice not only as a commodity but a valuable cultural resource and important part of their life—a genetic heritage that needs to be continuously developed, conserved and protected for their succeeding generations.

Sustainable agriculture is one rural development framework wherein the rice crop and production system would also means land, life and resources to farmers. And any discussion on rice development entails going through the subjects of genuine agrarian reform and ancestral domain, farmers' rights, appropriate technology, community-based seedbanking, ecological soundness and community development.

A lead rice research center avowed to uplift the condition of small rice farmers is therefore of strategic and paramount importance.

CAN IRRI PLAY THIS ROLE?

IRRI has since its inception four decades ago, manifests a biased development and research framework owing to the nature and benefactors of its creation. Instead of developing and protecting the vast and precious world collections of rice seed resources, it became tied-up to transnational agribusiness. IRRI's research focuses on the genetic trait determinism through genetic engineering and of subservience to patenting of life forms are manifestations of the reductionist path it is now taking . It is now increasingly beholden to private investments for its continued existence rather than to the small rice farmers it was supposed to serve. With the present orientation, the direction of its research work will not dare antagonize but instead complement research gaps of private agribusiness. The rice research partnerships can be considered as corroborative betrayal at the global order. IRRI continuously betrays the trust of peoples and nations who have contributed their seed resources and accompanying indigenous knowledge systems on rice.

It is high time that people-based agricultural research be built from the community up to a center-based research stations. And this time, peoples' research centers must be anchored and adhere to genuine people's development framework. Meaning the reason for being, must be based on the concrete conditions and needs of the small farmers in order to be effective in its work. It must appropriately address and respond to the corporate threats and plunder as well to privatization thrusts that tend to remove control of rice seeds and means of production from the small rice farmers. A farmer-based development and sustainability framework will never be compatible to corporate aims. Very vital is the role of rice researches to improve the agricultural economies of small farmers and nations that it must be put into a genuine people's development framework. Some of the important features are summarized below:

- research cooperation should be with rice farming communities and organizations and in strengthening their hold and development of their seeds;
- research cooperation should respond to the needs and aspirations of the small farmers;
- research should complement or strengthen farmers' on-field researches and must lead to self-sustaining and diversified rice based-farming systems;
- research should be participatory and consultative in nature and methodology;
- research should lead to more access and control of the means of production to the small farmers; and
- research should recognize small farmers as the main actors and beneficiaries of change and development.

CONCLUSION

Thus, it is the global framework of agro-chemical TNC domination that had clearly moved partnerships with public research institutions. IRRI was a key to opening wide the door for the usage of national research assets, and poses the threat of plunder to the world's germplasm kept in its genebank.

In the light of heightening commercialization and privatization, IRRI in partnership with the private agribusiness sector has been used and is continuously being used both as a venue and tool to perpetuate dependency by farmers to costly and ecologically destructive farm inputs — seeds (HYV, Hybrid, transgenic), chemical fertilizers and pesticides.

Indeed there is a failure on the development paradigm being espoused by IRRI. But despite this, it continuously operates under a mask of rhetoric and face-lifting pronouncements of being a pro-small farmer research institution. It pitifully fails to admit the mistakes of its 40 years of establishment and worse, continues its corroborative work with the private agribusiness and industry at the expense of the rice varietal treasures of the small farmers.

Hence, despite the rhetoric on participatory researches in the tail of the failures of the Green Revolution, IRRI continues to consider farmers as research subjects and passive recipients of improved varieties and transgenics being developed by formal breeders and scientists.

IRRI committed a grave betrayal of trust of governments by not according proper protection for the precious resources given in trust by donor countries. IRRI committed a grave betrayal of people by not making this germplasm collection available to farmers and farming communities, especially in the rice-growing parts of the world where these germplasm were collected.

Its formalized international status, its mandate as an IARC, nor its early non-profit organizational status -- could not grant IRRI neither the moral responsibility nor the mandate, to collect 85,000 rice germplasms from around the rice producing countries of the world, and open this to the utilization by TNCs for its corporate designs for modern biotechnology. The rice germplasm collection in the name of R&D could not be justified by promises of yield, especially that these failed the poor farmers – the owners of the germplasm. To allow TNCs to further utilize these will be the ultimate of IRRI's betrayal of rice farmers of the world.

IRRI cannot appeal to its so-called moral imperative to forge private-public partnerships. It was a creation by TNCs, its survival continues to be through TNC support, the TNCs benefit from its work -- thus it can only claim to a logical outcome of its creation to open up wider private sector hold. It only needed some legitimization and appeal to 'moral imperatives' because of the public character it had propped itself with.

Finally, what then constitutes public-private partnerships entered into by IRRI?

"Public-private partnerships" are referred to in CGIAR literature "as any collaborative effort between the public and private sectors in which each sector contributes to the planning, resources, and activities needed to accomplish a mutual objective" ...." (Kush, 2003). This definition suggests that public-private partnerships are a constructive means of enhancing the production of goods, services and technologies that would not otherwise be produced by either sector acting on its own.

Behind this, is the motive that solely moves public-private partnership in R&D. It is the desire by the powerful agro-chemical TNCs to capture the cooperation, expertise and resources of public research institutions to advance GE research agenda, and a means thus for TNCs to facilitate market expansion in developing countries. Such was the objective of the partnership with Syngenta on application research of the Golden Rice technology, and the partnership with Novartis and Plantech on the Bt gene constructs on tropical rice varieties.

Sam Dryden, former chair of the CGIAR's Private Sector Committee, confirms that one of the private sector's interests in cooperating with the CGIAR is that "this could potentially lead to the development of a new market, specifically those small-scale farmers who are in transition to fuller participation in the market economy". As noted by one biotechnology observer, the humanitarian endeavors of corporations have always been linked with a good business sense, as graphically stated by Jacques Barman, President of Novartis Foundation "... where people grow, profits grow: this well-tried business rule is applicable to development policy as well". It would be an illusion to expect corporations to collaborate with public research institutions on purported humanitarian grounds. ■

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ii Interview by E. Dano with Dr. Leo Sebastián, PhiliRICE Executive Director, 13 September 2004, Quezon City, Philippines.

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People's rally at the tribunal against IRRI

Appendices

1. **Verdict from the First Asian People's Tribunal against the International Rice Research Institute (2006)**

2. **People's Statement on Saving the Rice of Asia (2007)**

Judges of the Asian People's Tribunal against IRRI 2006

APPENDIX 1
Verdict from the First Asian People's Tribunal against the International Rice Research Institute

The First Asian People's Tribunal against the International Rice Research Institute (IRRI) held on 4 April 2006 in Quezon City, Philippines, found IRRI guilty of crimes against the farmers and peoples of Asia in its 46 years of existence in Southeast Asia.

The Tribunal was sponsored by the Asian Peasant Coalition (APC) and the Pesticide Action Network Asia Pacific (PAN AP) and was organized by Kilusang Magbubukid ng Pilipinas (KMP) and RESIST Network of the Philippines.

The theme of the tribunal was "End Imperialist Control in Agriculture! Intensify the Struggle for Genuine Agrarian Reform!". It was attended by more than 400 people, mostly peasants, scientists, academes and professionals coming from Malaysia, Pakistan and the Philippines.

ASIAN PEOPLE'S TRIBUNAL
DILIMAN, QUEZON CITY
PHILIPPINES

ASIAN PEASANT COALITION,
Complainant,

- versus -

INTERNATIONAL RICE RESEARCH INSTITUTE, GEORGE W. BUSH AS PRESIDENT OF THE UNITED STATES OF AMERICA, FORD AND ROCKEFELLER FOUNDATIONS, GLORIA MACAPAGAL ARROYO AS PRESIDENT OF THE REPUBLIC OF THE PHILIPPINES, ET AL.

Defendants.

x------------------------------------ x

FOR: VIOLATION OF WORKERS AND PEASANTS' RIGHTS, LANDGRABBING, CHEMICAL AND PESTICIDE POISONING, INTRODUCTION OF HYV AND GE SEEDS TO FACILITATE IMPERIALIST PLUNDER AND CONTROL OF SEEDS, PESTICIDES, TECHNOLOGY AND AGRICULTURE.

V E R D I C T

Prefatory

Moreover, locally, the IRRI has been with impunity wantonly violating the rights of workers and peasants. IRRI has grabbed some 222 hectares of farmers' land in Laguna, Philippines.

The International Rice Research Institute's (IRRI) 46 years of existence merely serves as an instrument of imperialist plunder and control in seeds, pesticides, technology and agriculture throughout the world.

IRRI through the Ford and Rockefeller Foundations since its beginning on April 4, 1960 at the University of the Philippines in Los Baños, Laguna, has restructured Asian farmers' sound traditional agricultural practices to become dependent and subjugated to chemical inputs that are products of TNC-controlled agribusiness. IRRI's chemical-dependent seeds and intensive capital-input high-yielding varieties (HYVs) have eroded continuously the traditional rice varieties (TRVs) of rice farmers, destroyed systematically the ecological system of agricultural lands, and put to great danger the life and health of farmers and peoples here and throughout Asia and the whole world.

Moreover, locally, the IRRI has been with impunity wantonly violating the rights of workers and peasants. IRRI has land-grabbed too some two hundred twenty two (222) hectares of farmers' land in Laguna, Philippines.

Parties

This is an indictment brought by the Asian Peasants and Peoples – or the peasants, farmers, fisher folk, agricultural workers, peasant women, rural youth, indigenous peoples of Asia-- in solidarity with other oppressed and exploited peoples of the world -- as Plaintiffs, through the Panel of People's Prosecutors.

This Indictment is against INTERNATIONAL RICE RESEARCH INSTITUTE, GEORGE W. BUSH AS PRESIDENT OF THE UNITED STATES OF AMERICA, FORD AND ROCKEFELLER FOUNDATIONS, GLORIA MACAPAGAL ARROYO AS PRESIDENT OF THE REPUBLIC OF THE PHILIPPINES, ET AL, who are acting, confederating, collaborating, cooperating or working with one another, and who participated or cooperated in the commission of the offenses herein described, or by their tolerance or inaction, despite knowledge thereof, allowed the commission thereof, hereinafter referred to as the **"Defendants".**

Charges and Violations

The Defendants are hereby charged by the Asian Peasants and Peoples of widespread and systematic **VIOLATION OF WORKERS AND PEASANTS' RIGHTS, LAND-GRABBING, CHEMICAL AND PESTICIDE POISONING, INTRODUCTION OF HYV AND GE SEEDS TO FACILITATE IMPERIALIST PLUNDER AND CONTROL OF SEEDS, PESTICIDES, TECHNOLOGY AND AGRICULTURE.**

Allegations

The above-named defendants, conspiring and mutually confederating with one another committed the above-mentioned charges as follows:

1. LAND-GRABBING

IRRI is also built on hectares of land illegally and immorally taken away from the farmers. In 1974, by virtue of Presidential Decrees (PD) 457 and 1046-A issued by the late dictator Ferdinand Marcos under martial law, landowners and tenant-tillers were forced to sell their lands for less than their worth. To prevent unrest, IRRI duped the farmers by hiring most of the displaced tenant-tillers as field workers and promising them "security of tenure" that would extend to their children. These are in reality empty promises that are being breached wantonly by IRRI.

In actuality, by virtue of these outdated and immoral laws including PD 1620, coupled with the Philippine government's unabashed coddling of IRRI, this imperialist institution has not only been able to take away from the farmers some two hundred twenty two (222) hectares of farmlands but likewise relegated the poor farmers to a position of hapless tenants and farm workers that would have been quickly disposed of by IRRI after serving their productive years therein. Worst, IRRI is getting away from all liabilities because of stupid local laws that protect IRRI and grant this imperialist institution immunity from suit in the Philippines.

In the testimony given by Danilo Ramos which was directly corraborated by the statements of Aurelio Mercado, respondents IRRI, the government of the Republic of the Philippines, and the Ford and Rockefeller foundations, are proven guilty beyond reasonable doubt of land- grabbing as a consequence of forcible acquisition of lands by virtue of PD 457 and PD 1046-A.

2. VIOLATION OF WORKERS AND PEASANTS' RIGHTS

Using an immoral and unconstitutional Marcosian Decree (Presidential Decree 1620), IRRI has and continuously been subverting the rights of the Filipino workers by conducting union-busting activities like massive harassment of unionists and their leaders, implementation of mass lay-off and dubious retrenchment programs. Hundreds of Filipino workers were illegally and arbitrarily terminated.

Worse, some of these workers who were arbitrarily severed from work, were also suffering from work- related illnesses or those directly brought about by chronic exposure to toxic chemicals and pesticides. A number of them have never recovered and died already of these work-related illnesses such as cancer, liver ailments, Parkinson's disease, etc. They died without receiving anything by way of compensation and or benefits from their work or devotion of their productive years with IRRI.

These workers were subjected to IRRI's anti-worker policies and practices. IRRI has shrewdly used PD No. 1620 to give itself "immunity from civil and legal cases." Under PD No. 1620, the rights of IRRI workers and employees have been even more exploited, violated and repressed. What made things more miserable, the Philippine Supreme Court and the Department of Labor have callously sided with IRRI by unreasonably upholding this stupid and unwarranted immunity.

To date, more than 500 Filipino workers have already been forcibly retrenched by IRRI through its Staff Adjustment Program that started in 1990. The workers that objected to and fought this scheme were the first victims of this "program". Many of them were members of the Brotherhood of IRRI Workers Support Services Group (BISSIG). Cases were filed at the Department of Labor (DOLE) but they were eventually dismissed because of PD 1620.

Based on given testimony as clearly established in the visual presentation, oral arguments and statements pronounced, and on documents at hands, IRRI is guilty of violation of workers and peasants rights as provided for in Section 3, Article XIII; Section 11, Article II; and Section 18, Article II of the 1987 Constitution of the Republic of the Philippines.

PD 1620, which is constitutionally defective law, cannot be the basis for immunity since IRRI has no standing in international law and therefore cannot enjoy immunity from suit based on international law.

3. CHEMICAL AND PESTICIDE POISONING

The life and health of Filipino workers and employees in IRRI were shamelessly forsaken in the name of greed and profits. Farmers have been enormously exposed to chemicals and pesticides and become victims of toxic chemicals and pesticides being used in the experimental fields.

Because of this, eight IRRI workers have already died of dreaded diseases as a consequence of exposure to chemicals and pesticides during their employment with IRRI. These hapless field workers died without seeing the dawn of social justice in the name of rice research.

The IRRI management did not even bother to look into these cases of rampant deaths and illnesses directly resulting from use of chemicals and pesticides. On the contrary, IRRI has even tried to whitewash the truth, despite the fact that several television stations have already uncovered and featured the real story behind IRRI and this IRRI-work-related chemical and pesticide poisoning.

Outside IRRI, the effects of chemicals and pesticides being applied to seeds and crops are equally being experienced by farmers who were programmed to use these toxic chemicals and pesticides into the IRRI-designed seeds and crops. In turn, the consuming public would have eaten these crops produced out of these toxics and poisons. This is a local and global scenario directly attributed to this IRRI program of toxics and poisons.

The studies on Health Effects of Pesticides on Former IRRI Workers in 2000 fervently manifested the ill-effects of experiments conducted by IRRI. The oral testimony of Dr. Romeo Quijano further revealed the adverse effects of chemicals and pesticides on the health and lives of IRRI workers. Therefore, IRRI is guilty of chemical and pesticide poisoning.

4. GREEN REVOLUTION AND GENE REVOLUTION: TOWARDS CONTINUING IMPERIALIST PLUNDER AND CONTROL OF SEEDS, PESTICIDES, TECHNOLOGY AND AGRICULTURE ALL OVER THE WORLD

Corollary to this, in 1966, IRRI released its IR8 rice seed - it spread in Asia so fast and it was nicknamed “miracle rice.” Unfortunately, the IR8, IRRI’s high-yielding varieties (HYVs), required vast amounts of pesticides and fertilizers, jacking up the cost of production and destroying the environment. Native snails, frogs and crabs being used by farmers and their families as naturally abundant free viands disappeared from the rice fields.

The Green Revolution ended harshly and hazardously. It destroyed farm lands and crops. It left millions of farmers hungry and landless.

It poisoned our foods, destroyed biodiversity and threatened food security, our health and the environment.

IRRI crimes do not stop there. It is continuous. IRRI is now involved in the second generation of transgenic crops or genetically engineered (GE) seeds. Or what is now called "Gene" Revolution and we are again being made to believe that it will end hunger. But the GE being driven by agrochemical TNCs and strongly supported by the US government is a global drive to open new markets, gain dominance and control over the world's food, seeds and agriculture.

Worst, the World Trade Organization (WTO)'s Agreement on Agriculture (AoA) was even more designed to promote biotechnology, TNCs, corporate farming and industrial agriculture. The Gene Giants have tactically used the WTO to open up restricted markets and GE played a major role in this WTO strategy.

These were done through funding of intensive agricultural biotechnology research and development no other than by seed companies and agro-corporations. Globally, western countries have infused some US$6 billion annually to aid research and development, and over US$7.5 billion a year is spent on in-house biotechnology programs.

The seed – which contains all the hard work of farmers and the culture instilled on it brought about by centuries of local farming tradition – is being manipulated to serve the interest of these TNCs. Right now, the Philippine government is also carrying out high-profile propaganda moves for people to accept its thrust for biotechnology in rice.

The government, through IRRI and its local counterpart, Philippine Rice Research Institute (PhilRice), is trying to get the people to accept the introduction of transgenic rice such as the hybrid rice and the BB (bacterial blight) rice.

The Philippine government - through the help of agrochemical TNCs-funded institutions and research bodies such as IRRI, the International Service for the Acquisition of Agri-biotech Applications or ISAAA, also based in Laguna (whose mandate is the transfer and delivery of biotechnology products in developing countries), the World Bank-funded Consultative Groups on International Agricultural Research (CGIAR), among others – continue to conduct research and development and science and technology programs under the framework of the "free market" and globalization.

Moreover, the national sovereignty of the Philippines is blatantly and shamelessly being violated by IRRI. With the help of an imperialist puppet government like the Arroyo Government, IRRI continuously plunders the genetic resources and patrimony of various countries particularly in Asia.

Likewise, IRRI would definitely benefit on the Charter Change being pushed by the Arroyo government that will allow 100 per cent foreign ownership of land in the Philippines, making IRRI stay in the country for ever.

The oral testimony of Dr. Shahid Zia further reveal that Basmati rice in India and Pakistan was patented by IRRI including Jasmine rice in Thailand and each government found it difficult to challenge the patenting because of the TRIPS in the WTO.

In another testimony of Sarojeni Rengam, she testified that IRRI's research agenda is for profit and working with the grassroots will truly determine what kind of research and technology should be done among the farmers in Asia.

Therefore, the Philippine government of Gloria Macapagal Arroyo, Ford and Rockefeller foundations, US President George W. Bush, and IRRI are guilty of plunder, control of seeds and agriculture as clearly manifested by the testimonies.

Evidence

These general and specific allegations shall be substantiated and proven before the Asian People's Tribunal through testimonies of victims, material witnesses, and their relatives and documentary and object evidence including videos, PowerPoint presentations, publications, fact sheets, affidavits, fact-finding mission reports, judicial records; and the reports and/or studies of the organizations who are participating in the Asian People's Tribunal.

The peasants and the People in general will establish that the Defendants, despite their knowledge of the atrocities and their corresponding obligation under the Constitution and international laws of their responsibility to protect and observe the rights of the peasantry, the farmers, the farmworkers, and the peoples, not only failed to prevent the commission of such crimes but on the contrary committed, tolerated, abetted and encouraged the same.

Call to Action

The Asian People and the peasantry, after establishing the guilt of the defendants in the crimes charged, respectfully recommend to the Asian People's Tribunal the following penalties, sanctions and measures:

That –

1. The IRRI be abolished and the imperialist institutions behind it be banned from operating in the Philippines and elsewhere;
2. The local laws upholding and protecting IRRI, especially P.D. 1620 be repealed and or scrapped;
3. The government of the Republic of the Philippines be made to answer also for its complicity to these IRRI crimes on the local peasants, workers and people, and be pressed to decisively take steps that will abolish IRRI and halt IRRI atrocities;
4. The findings of this Tribunal be invoked among solidarity groups and individuals locally, regionally, and in the

international community to support the Asian peasants and rural People's struggle;

5. The Defendants be made to pay compensation and indemnification for the victims' rehabilitation, restitute their material and moral damages, and issue a sincere public apology to the people as well as to the other oppressed and exploited peoples;

6. Local and international pressure be exerted on IRRI and the United States of America to desist from these criminal acts, imperialist plunder and control of seeds, biotechnology, land and agriculture, particularly of the Asian countries;

7. The Defendants be further charged or complaints be filed with the United Nations and its pertinent committees and Special Rapporteurs, the International Criminal Court (ICC) under the Rome Statute, the United Nations Human Rights Committee (UNHRC), and the Organization of Islamic Countries (OIC);

8. The Tribunal to further demand the creation of a legitimate and independent body to try crimes committed in furtherance of the immoral and illegal IRRI programs here and in other Asian Countries;

9. The Government of the defendant United States of America be admonished and pressed to renounce and stop its other imperialist policies and actions; and

10. The concerned Defendants other than IRRI, having been notified and given an opportunity to be heard and after a rendition of a Guilty Verdict by a College of Jurors to be constituted under the authority and supervision of a Presidium of Judges, be forcibly ousted or overthrown from positions of power and perpetually and absolutely barred from holding any public office;

OTHER RELIEFS, as may be deemed proper under the premises, are likewise sought and prayed for.

University of the Philippines, Diliman, Quezon City, Philippines.
April 4, 2006.

PANEL OF PEOPLE'S PROSECUTORS:

Dr. AZRA SAYEED
Pakistan

Dr. GIOVANNI TAPANG
Philippines

Dr. Romeo Quijano taking an oath at the Asian People's Tribunal against IRRI 2006

APPENDIX 2
People's Statement On Saving The Rice Of Asia

We, representing the peoples and grassroots of Asia, state our strong stand on the issue of RICE in Asia and call upon all those responsible for agricultural and food policies at national, regional and international levels to take immediate action to safeguard the rice heritage of Asia.

PREAMBLE

Rice – the Life of Asia

Rice is Asia's most deeply revered treasure. It is central to the Asian way of life; its culture, spirituality, traditions and norms. The staple food of three billion Asians, half the world's population, Rice is Life to the people of Asia.

Rice has been grown in Asia for the last 7,000 years. Recent findings in China indicate that this may in fact be 10,000 years. Local and traditional rice varieties and ecological rice farming have sustained Asian rice farmers and consumers safely for most of foregone decades.

The core elements of this rich heritage of rice are enshrined in the "Five Pillars of Rice Wisdom". These are: *Rice Culture, Community Wisdom, Biodiversity-based Ecological Agriculture, Safe Food and Food Sovereignty.*[1]

The Threats

In the last five decades, our rice heritage has been severely eroded and is under grave danger of being lost completely.

With globalization and the implementation of the WTO's Agreement on Agriculture (AoA), control over rice production and agriculture in general has moved more and more from farming communities and peasants to agrochemical transnational corporations (TNCs) and developed imperialist countries such as the US, and those in Europe.

Arrogant trade liberalization policies coupled with corporate agriculture have wiped out and continue to wipe out peasant rice farmers all over Asia as well as small rural entrepreneurs who depend on rice for their livelihoods.

Land for rice has been converted to land for cut-flowers, bio-fuel, shrimp cultivation, cassava, animal feed, industrial use, amusement parks, real estate development and special economic zones. These so-called development projects displace farmers from the land they till.

Through the intellectual property rights regime enforced by TRIPs and bilateral trade agreements (TRIPs-plus), rice seed varieties are moving from the hands of farmers, particularly women, and indigenous communities to those of seed companies and privatized agencies.

This trend in rice production and the increasing dependency of our countries on the import of rice as food is a grave threat to our food sovereignty and national sovereignty. Ecological rice farms which could adequately sustain farming communities in the past have been turned into corporate monocrop factories filled with poisonous chemicals.

The only interest of global powers and agri-business in rice today is to make it a commodity to be traded in the international market to amass more profit. This agenda is exacerbated by institutions like the International Rice Research Institute (IRRI) which collaborate with industry and facilitate the corporate control of seeds and agriculture. The control of seeds and agriculture rightfully belongs to the farmers of the land.

Through the so-called Green Revolution, corporate agriculture has poisoned people and rice fields with pesticides and synthetic fertilizers; degraded rice lands; destroyed rice ecosystems, ecological rice practices and rice culture; and severely undermined the safety of the cereal as food.

Agri-business has paved the way for hybrid rice and now, genetically-engineered (GE) rice such as Golden Rice, Bt Rice and Liberty Link Rice, and has brought about not only the loss of strong and unique local and traditional rice varieties, but their contamination as well. The FAO report "The State of Food and Agriculture 2003-2004" supported genetic engineering as a solution to world hunger but it is not the answer. GE will only make the problem of world hunger worse.

There is sufficient evidence to show that biodiversity-based ecological rice agriculture is sustainable. Conversely, there is ample evidence to show the failures of corporate rice farming and **no** evidence to show GE Rice is safe.

OUR STAND

As the people of Asia, we hereby irrevocably state our stand:

1. We affirm that:

- Rice Culture, Community Wisdom, Biodiversity-based Ecological Agriculture, Safe Food and Food Sovereignty should be the basis of rice cultivation, consumption and trade globally.
- Farmers' knowledge and traditional rice culture and rice cultivation practices should be conserved, preserved and protected.
- Landlessness should be addressed by genuine agrarian reform led by genuine peasant movements in Asia.
- Local and traditional rice varieties should be conserved, preserved and protected. Our rice genomes should not be given to and used by corporations for profit. Rice genomes held by research organizations like IRRI should be given back to the local communities.
- Rice-farming communities, especially peasant and indigenous communities, should be protected.

2. **We resolutely protest against:**

   - The use of pesticides and synthetic fertilizers on our rice farms. Rice-ecosystems should be conserved.
   - The use and depletion of ground water in rice crop cultivation.
   - High-input varieties and hybrid rice. Our local, traditional and farmer-bred rice varieties are good enough and healthier for us.

3. **We resolutely reject:**

   - GE Rice. We do not want to feed ourselves or our children GE food in any form. We will unequivocally oppose the introduction of GE rice in Asia.
   - The genetic modification, patenting or external ownership of our rice seeds in any way. There should be No Patents on Life!
   - The WTO and its conditionalities and control over food and agriculture.

4. **We resolutely condemn** the actions of organizations like the International Rice Research Institute in collaborating with industry against the good of rice farmers and rice cultivation.

OUR CALL

To ensure food for our millions and to stop hunger, rice cultivation and production and rice lands must return to our peasant farmers and communities. **It is in Rice that we reclaim our rights and the rights of our future generations to our culture, our livelihood, and freedom from hunger.**

WE CALL UPON ALL DECISION-MAKERS OF AGRICULTURAL AND FOOD POLICIES WORLDWIDE TO TAKE THE FOLLOWING ACTIONS WITH IMMEDIATE EFFECT:

1. **Enable global and national initiatives to preserve, protect and uphold rice culture and biodiversity-based ecological rice agriculture.**
2. **Preserve and protect the lands and food sovereignty,** rights and livelihoods of peasant rice farmers and rice farming communities, especially indigenous communities. Dismantle agreements, policies and laws that enable the liberalization of trade in rice and agriculture.
3. Adopt the Precautionary Principle in deciding on genetically-engineered seeds and food. **Introduce an all-out ban on genetically-engineered rice.**
4. **Adopt the policy of "No Patents on Life".** Bar the patenting of rice seeds and traditional knowledge.
5. **Protect traditional local rice varieties.** Support and strengthen farmers' local seed conservation systems.
6. **Ensure the safety of rice and rice ecosystems.** Ban the use of pesticides and synthetic fertilizers in rice fields. Enforce the use of safer, ecological-based pest and weed management alternatives.
7. **Strictly limit the use of ground water for irrigation** and ensure the sustainable use of ground water.
8. **Undertake genuine agrarian reform.**
9. **Uphold the People's Control on Agriculture!** Implement farmer-centred agricultural research and systems.
10. **Close down IRRI** and regulate the activities of collaborating institutions, such as PRRI and BRRI, in different countries. Return the rice seeds collected to the local communities.

We urge all decision-makers of agricultural and food policies to listen to the earnest voices of the people of Asia whom you have pledged to protect and act on these recommendations immediately. Ensure the protection and well-being of all the people and rice farmers of Asia.

We will resolutely persevere in our stand and efforts to save the rice of Asia.

Thank you.

8 February 2007

ENDNOTE

[1] The Five Pillars of Rice Wisdom

- **Rice Culture:** rice as the embodiment of spirituality, beliefs, traditions, customs, norms, practices and celebration.
- **Community Wisdom:** the authentic knowledge of farmers gathered over generations, incorporating intuition, spirituality and ethics; and the role of women as custodians of seeds.
- **Biodiversity-based Ecological Agriculture:** chemical-free, organic, sustainable rice cultivation; the conservation of local rice seed varieties; and the maintaining of biodiversity in rice ecosystems.
- **Safe Food:** rice as a food without poisons and rice production without the utilization of hazardous technologies such as pesticides and genetic engineering.
- **Food Sovereignty:** the rights of peoples, farmers and communities to adequate, culturally-appropriate safe food; land and productive resources;, and in deciding on food and agricultural policies; and the practice of gender justice.

"This handbook deals on the impacts and trends of rice research by the International Rice Research Institute (IRRI) and contains a number of articles written by various authors The authors report of an initial increase in rice yields, owing mainly from the application of chemical fertilizers, pesticides and more extensive irrigation systems. When there were pests, more pesticides were simply applied. Where there was poor soil fertility, more chemical fertilizers were simply added, and when it failed, the seeds were simply replaced with another variety. When the farmers were too poor to buy the chemical inputs, they were simple given loans. When problems persisted, farmers were simply blamed for not following instructions or not understanding the technology. Ten years from the introduction of high yielding varieties, pests were becoming a more serious problem. Twenty years after their introduction, farmers started to realize that they were going nowhere—there were increasing costs of production, and yield had reached a plateau.

Loss of agricultural biodiversity has occured not only in rice varieties, but extends to the various plants and wildlife growing in or along the rice fields. These wildlife and plants are very important to resource-poor farmers because these are an integral component of the latter's nutrition, serving as a cheap source of protein and vitamins. Edible plants and animals were eliminated due to pesticide poisoning or simply non-preference in a has a positive connotation (clean) mono-cropping culture of rice.

The sustainability of rice farming is now under threat because over-reliance on chemical fertilizers, coupled with highly intensive rice farming system, has caused a serious decline in natural soil fertility. Soil chemical imbalance, micronutrient deficiencies, chemical toxicities, and acidification has become prevalent. Likewise, soil organic matter has been seriously depleted in most intensive rice areas. Loss of groundwater is also aggravated in water-scarce areas. Food security is, therefore, threatened.

It is apparent that the articles in this resource book were written in different tones, on different objectives and at different times. But all the authors have arrived at the same conclusions about the negative environmental, health, economic, and social impacts of IRRI. They all question the relevance, effectiveness, safety and sustainability of IRRI technology."

Dr. Charito Medina
MASIPAG

Pesticide Action Network Asia and the Pacific (PAN AP)
P.O. Box 1170, 10850 Penang, Malaysia
Tel: (60-4) 657-0271/ 656-0381
Fax: (60-4) 658-3960
Email: panap@panap.net
Website: www.panap.net

Sibol ng Agham at Teknolohiya (SIBAT)
4F / 5F 40 matulungin Street,
Brgy. Central, Diliman, Quezon City
Tel.: +632 928-8316/ +632 926-8971
Email: sibat01@pldtdsl.net
sibat_02@pldtdsl.net
Website: www.sibat.org

ISBN 978-983-9381-35-1
9 789839 381351