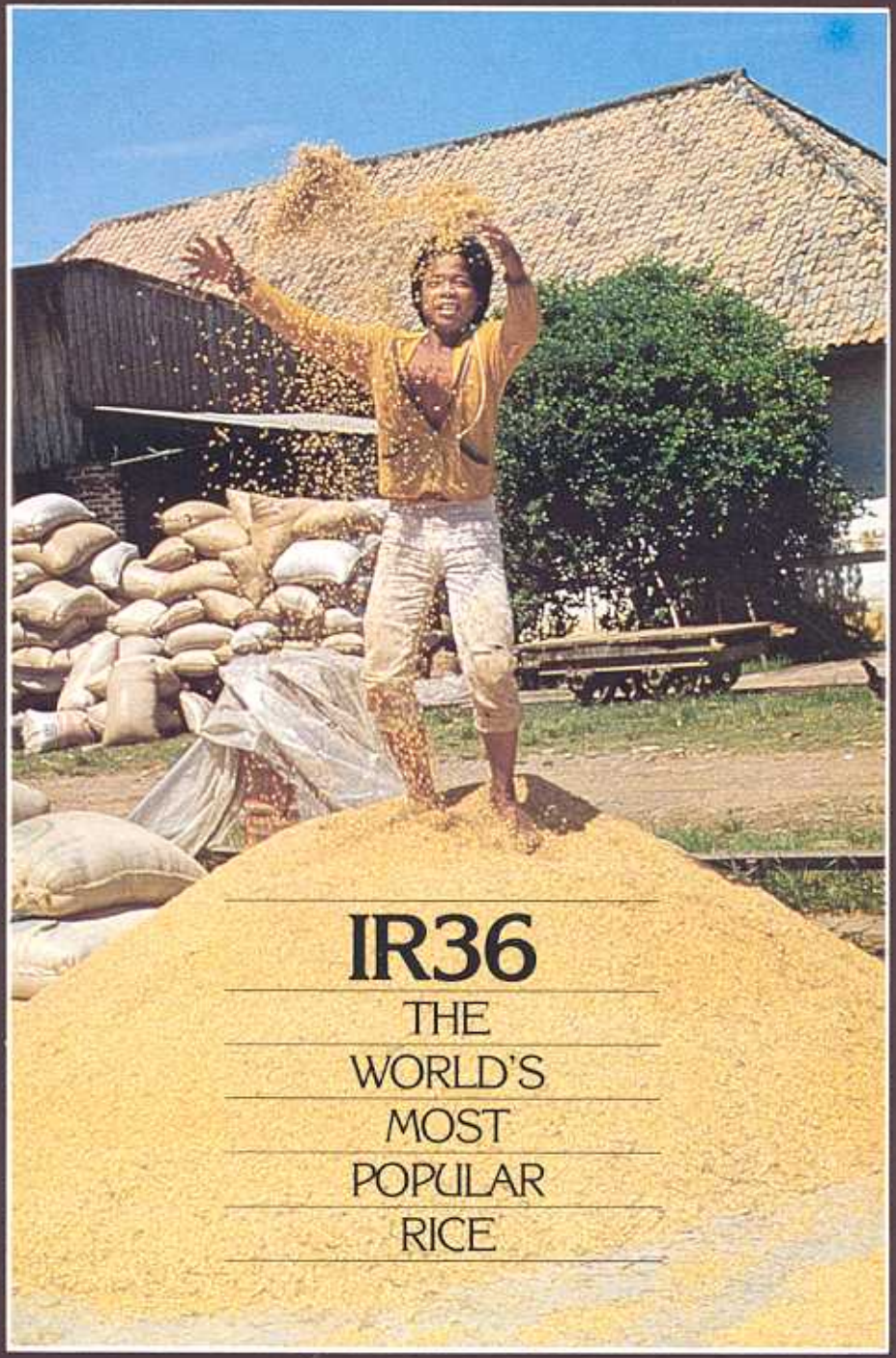


IR36

THE WORLD'S MOST POPULAR RICE

INTERNATIONAL RICE RESEARCH INSTITUTE

IR36

Risk in English. *Pañganib* in Pilipino. *Bahaja* in Indonesia. Whatever the language, the nation, or the people, risk, more than any other word, controls a farmer's life, and through farmers, the lives of all humanity.

IR36, an early-maturing, high yielding, insect- and diseaseresistant rice variety, has eliminated some of the risks a rice farmer takes each time a seed is planted.

Since 1976, when Philippine farmers first planted IR36, it has become the most widely grown variety of any food crop the world has ever known*. Almost 11 million hectares of IR36 are now planted worldwide.

Sixty-five percent of all rice grown in the Philippines and 60% of the rice in southern Vietnam and Indonesia is IR36. India, Malaysia, Kampuchea, Laos, Bangladesh, Sri Lanka, and other nations harvest millions of tons of IR36.

Agricultural economists estimate Asian farmers harvest an additional 5 million tons of rice each year, and gain more than $1 billion extra income, because they plant IR36. Its insect-resistant properties save nearly $500 million in insecticide costs annually.

The International Rice Research Institute (IRRI) Quinquennial Review Mission, composed of 10 internationally recognized authorities, wrote: "The impact of IR36 alone would more than justify the investment in IRRI since its inception 21 years ago."

IR36 was developed at IRRI by crossbreeding 13 parents from 6 nations - India, Indonesia, China, Vietnam, the Philippines, and the USA. An interdisciplinary team of IRRI scientists and cooperating scientists from national rice improvement programs field-tested IR36 in irrigated and rainfed wetlands and in drylands. Extension workers of many nations took the versatile variety to farmers.

IR36 - it is called PB36 in Indonesia and NN3A in Vietnam - is but one of many varieties developed at IRRI since the Institute opened in 1962.

IRRI released its first semidwarf variety, IR8, an IR36 ancestor, in 1966. IR8 yielded high, responded well to nitrogen fertilizer, and took 30 days less to mature than traditional varieties, but it had little tolerance for insects, diseases, or environmental stresses such as drought. Its grain quality was poor compared with many native rice varieties.

IR20, released in 1969, was the first IRRI variety selectively bred to withstand insects and diseases. By 1972 it had replaced IR8 in many regions. However, in 1973 it was attacked by brown planthopper (BPH), which had become a serious pest in Asia.

IR26, released in 1973, yielded well and was resistant to BPH. IR26 also resisted attacks of tungro (RTV), bacterial blight (BB), green leafhopper (GLH), stem borer (SB), and several other pests.

In 1976 fields of IR26 in the Philippines, Indonesia, and southern India suddenly became susceptible to BPH. A new strain, BPH biotype 2, had emerged. By that time experimental rice varieties with new genes for BPH resistance were under test. IR36 was released as a variety resistant to the new biotype.

Early crosses leading to IR36 were made in 1969. An early maturing selection from an IR8/Tadukan (a Philippine variety) cross was crossed with another early-maturing line from a cross of TKM6 (from India) and Taichung Native 1 (from Taiwan, China), selected for BB and SB resistance and for excellent grain quality.

Many of the F_5 progenies of this cross, IR1561, planted in November

*The only other grain varieties that come close to matching IR36 in farmer acceptance are Bezostaya 1, a wheat variety developed in the USSR, and an aggregation of several semidwarf wheat varieties selected from the Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT) cross 8156.

Above: Harvesting IR36 in the Philippnes Right Transplanting IR36 in Sri Lanka.

In tests at the IRRI farm to determine reactions to BPH and virus diseases, Peta and IR8 were badly damaged, but IR36 was not.

1970 were resistant to BB, SB, and BPH, but were susceptible to GLH, RTV, and GSV.

Also in 1969, Oryza nivara, a wild rice from India, was discovered to resist grassy stunt (GSV). It was crossed and backcrossed with IR24 three times to produce a variety resistant to GSV and with IR24 grain qualities.

In 1971 an IR1561 F_5 progeny was crossed with a GSV resistant plant from the *Oryza nivara* and IR24 backcross. This progeny was crossed with a third parent, CR94-13 from India, which is resistant to gall midge, RTV and GLH.

In 1972, F_2 seeds of this cross were grown, without insecticide protection, at Maligaya Rice Research and Training Center in Central Luzon, Philippines, where RTV and SB incidence was high.

Researchers harvested 937 plants resistant to SB and RTV at maturity. Progenies were grown, unprotected by insecticides, at the IRRI farm in December 1972. BPH population in the fields was high. Susceptible plants died.

These progenies were also tested for resistance to BLB, blast (BI), and GLH. In March 1973 lines with multiple resistance had been chosen and seeds collected.

In 1973 and 1974 selected progenies were field tested for resistance to various diseases and insects at the IRRI farm in Los Baños and at other sites in the Philippines; in Lanrang, South Sulawesi, Indonesia; and in Cuttack, India. IR2071-6251-252 was selected from these tests as having multiple disease and insect resistance.

In 1975 Philippine Seed Board tests, IR2071-6251-252 outyielded IR30 by 13% in dry season and 21% in wet season, and was the highest producing entry during both seasons. In May 1976 the Seed Board named that line IR36. Under most farm conditions, IR36 yields 4-6 t/ha; in research trials it has yielded 9 t/ha.

In International Rice Yield Nursery trials that same year, IR36 outperformed 16 entries tested at 24 sites in 9 countries. IR36 has been an international check in the trials since 1977 and has consistently placed among the top three yielding entries.

Within a year of its release in the Philippines, IR36 replaced IR26, then the dominant variety. Indonesia recommended IR36 in 1977. It became the most widely planted variety by 1979. In East Java and Bali as much as 90% of the rice area is planted to IR36.

BPH destroyed thousands of hectares of rice in southern Vietnam in 1977. Later that year 250 tons of IR36 seed were imported from the Philippines and distributed to farmers for crash-planting. By 1980-81 60% of the rice area in southern Vietnam and some areas of northern Vietnam were planted to the variety.

The All-India Coordinated Rice Improvement Project (AICRIP) trials evaluated IR36 in 1978. It was number one of 16 varieties grown at 56 sites throughout India. The rice was named an All-India variety in 1981.

Kampuchea and Laos received 1,000 tons of IR36 seed in 1980-81. IR36 is recommended in East Malaysia, and is being tested in Burma, Malagasy, Mozambique, and Zambia. Although not recommended in Bangladesh and Sri Lanka, it is successfully harvested in some districts.

IR36 is being tested in China, the worlds largest rice producing nation. Chinese farmers grow several IRRI varieties with multiple disease and insect resistance, among them IR26 and IR28. IR26 is used as a restorer parent for F_1 hybrid rices, which are grown on 6 million hectares.

Rice is life for many in Asia and the Pacific. In Indonesia rice is the principal food crop. Millions in the cities and villages of India and Vietnam and the Philippines depend on rice for primary daily sustenance.

IR36 and other IRRI varieties and

Hand-threshing in the Philippines.

technologies are helping to improve and stabilize the lives of these people.

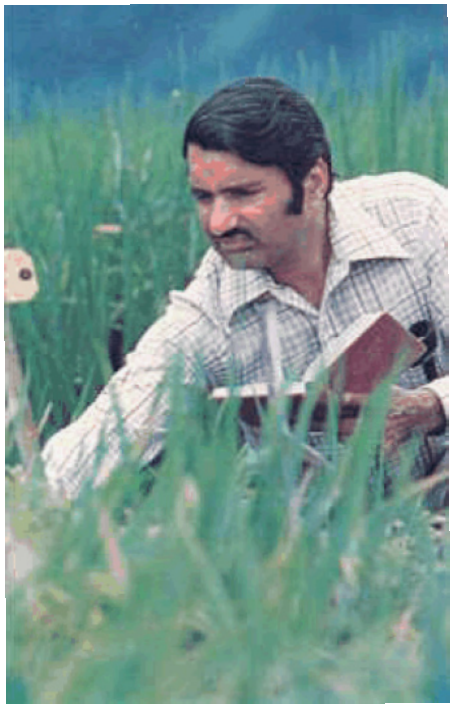
Before IR36, the Philippines was a rice importing nation. The Philippines exported rice for the first time in 1978. Indonesia is more self-sufficient and annual per capita rice consumption has increased from 115 kg in 1970 to 130 kg in 1980.

Increased Indonesian rice productivity is helping reverse the tide of

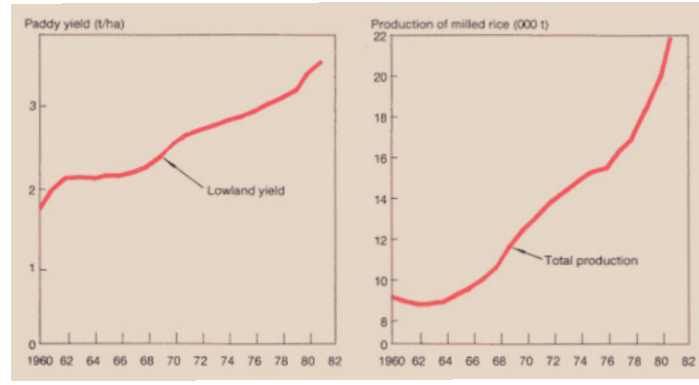
Above: Transplanting in Thailand. *Right:* Using a small threshing machine in India.

Qualities that have made IR2071-625-1-252 (IR36) the most widely grown rice variety in the world. (IR36 parents are: TKM6[2]/TN1//IR8/Tadukan///IR24[4]/*0. nivara*/4/CR94-13)

Disease resistance	Insect resistance
blast	brown planthopper
bacterial blight	biotype 1
tungro	biotype 2
grassy stunt	green leafhopper
	gall midge
	stem borer
Adverse soil tolerance	**Climate**
salinity	wetlands
alkalinity	irrigated
iron toxicity	rainfed
boron toxicity	rainfed drylands
aluminum toxicity	drought tolerant
zinc deficiency	
iron deficiency	
Grain quality	**Maturity**
long, slender, translucent	110 days
good cooking	
high milling	



Dr. Gurdev S. Khush, leader of the IRRI team that developed IR36.



Lowland paddy yield and total milled rice production in Indonesia, 1960-1 981 .

immigration from farm to city, according to Richard Critchfield in *Villages.* Farmers are coming home to their fields and a safer and more profitable lifestyle than they left.

IR36 could not have become the most widely planted rice variety in the world had it not been for many national programs and thousands of workers outsideIRRI.

In the Philippines, the Masagana 99 rice program, Bureau of Agricultural Extension, and Bureau of Plant Industry were major liaison groups that helped farmers learn about modern rice varieties. Through them, farmers received seed for IR8, IR20, IR26, IR36, and others, and learned to apply new fertilizer, weed control, planting, and harvesting technology.

In Indonesia, the BIMAS cooperative extension program encourages farmers to use modern production practices; makes noncollateral credit available for seed, fertilizer, insecticides, and herbicides; and provides technical assistance through extension workers.

Dr. Gurdev S. Khush, plant breeder and leader of the IRRI team that developed IR36, stresses the importance of broadening the genetic base of new varieties.

IRRI has developed IR50, IR52, IR54, and IR56, as named by the Philippine Seed Board. These varieties have multiple disease and insect resistance from different genetic sources than IR36. In Indonesia, the Philippines, and several other countries these varieties are beginning to replace IR36 where it has been grown almost in monoculture.

The spread of these and other new lines being developed at IRRI and by national rice improvement programs will provide farmers more safety through greater varietal diversification.

With each new variety developed there is a need for new cropping systems and technology. With IR36, where one crop was produced, often two crops can now be harvested. Where two crops were planted, three can be grown. New irrigation systems and new land preparation and planting methods have been devised to meet rapid cultivation needs.

Cropping systems experts have developed ways to latetransplant IR36 and produce grain 70 days after transplanting. Other scientists are fine tuning herbicide and fertilizer applications to use less and receive more benefit from that used. Economists are studying ways to help farmers become more efficient managers of labor and machinery.

It is through the development of improved varieties such as IR36 that national programs, and the farmer, will continue to reduce risks that threaten the grain so essential to alleviating world hunger.

The International Rice Research Institute (IRRI) receives support from a number of donors, including the Asian Development Bank, the European Economic Community, the Ford Foundation, the International Fund for Agricultural Development, the OPEC Special Fund, the Rockefeller Foundation, the United Nations Development Programme, and the international aid agencies of the following governments: Australia Belgium Brazil Canada, Denmark Federal Republic of Germany, India, Japan, Mexico, Netherlands, New Zealand, Philippines, Spain, Sweden, Switzerland, United Kingdom, United States.

The responsibility for this publication rests with the International Rice Research Institute.