CAMBODIAN RICE FARMER, Marie, is participating in a field trial that should enable her and her fellow farmers to grow more rice while saving money and resources that can be invested in other crops. The intensified system has some farmers growing the fast-maturing aromatic variety, Phka Rumduol (*right, above and top*). During the trial, farmers also use traditional methods and varieties (*opposite bottom and right*).

Intensify to diversify

Story and photography by Leharne Fountain

Smarter rice growing gives Cambodian farmers an opportunity to try new crops and gain more income

Every year since 1995, Cambodia has produced a rice surplus. It is an impressive record given the agricultural devastation wrought by the violence of the 1970s. Yet many Cambodian rice farmers still harvest yields of only 2 tons per hectare, barely enough to feed their own families. Rice is the most important source of income and employment for rural Cambodians, and the source of around three-quarters of the average Cambodian's calories. Productivity gains in rice, more than in any other crop, will therefore help reduce poverty.

One of the proven routes out of poverty is income diversification — if the rural poor can make money from a number of enterprises, not only does this provide extra income, but it also offers them a buffer when things go wrong, such as crop failure. Moreover, rice farmers perched on the edge of self-sufficiency are denied the chance to improve their lot. They are forced to devote all their energies to rice just to stave off hunger for themselves and their families. In short, better rice production opens the door to more lucrative farming.

A short drive out of the Cambodian capital Phnom Penh, Preap Visarto, head of the Plant Protection Program at the Cambodian Agricultural Research and Development Institute (CARDI), and International Rice Research Institute (IRRI) Senior Scientist Gary Jahn are conducting the Farmstead field trial, a 3-year project supported by the Australian Centre for International Agricultural Research (see *Donors corner* on page 5). Farmstead consists of around 6 hectares of rice fields in a relatively favorable rainfed environment. Standing for "Fish and Rice Management System to Enable Agricultural Diversification," the project fields are located by a canal that can provide supplemental water to nearby fields, although not enough to grow a fully irrigated dry-season rice crop.

Farmstead aims to help farmers intensify their rice production, thereby allowing the small amount of extra water, land and other resources consequently freed up to be invested in growing other crops, which can provide supplementary income for farmers. In addition, the project aims to design systems of intensification that complement, rather than hinder, ricefield fish farming, an important source of income and protein for many farm families in this region.

The trial will compare intensified fields with conventionally managed fields, focusing on yields, crop loss, profit margins and fish production.

Two rice varieties are grown in the intensified fields. Farmers first grow an IRRI-developed modern variety known as IR66, which matures in 2 months. Once IR66 is harvested, they plant a variety named Phka Rumduol, which was developed for rainfed systems by CARDI and matures in 3 months. These varieties, each planted once a year, during the rainy season, were chosen because they can be grown and harvested in synchronization with the 5-month variety, named Phka Khnhei, traditionally grown in the region. The total growing period is crucial, as sufficient water is available for only 5 months.

Other considerations were improved yield, grain quality and market value. Phka Rumduol, for instance, fetches a higher market price because of its aromatic qualities. The CARDI-designed Farmstead system also seeks to increase yields by leveling fields, improving fertilizer application and water management, and using certified seed to ensure seed quality.

Starting in 2004, the project has already delivered promising results. The intensified fields of Phka Rumduol produced significantly higher yields than traditional farmers' fields — 3.3 tons per hectare, compared with only 3 tons per hectare in fields planted to Phka Khnhei. Add to this another 3 tons per hectare from IR66, and the intensified fields are yielding more than double what they produced in the past.

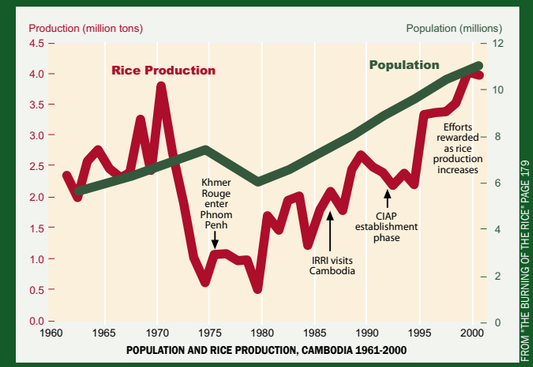
Dr. Jahn and his CARDI collaborators are also measuring crop loss from pests. Small subplots within the intensified and conventional fields are either treated with pesticide or left untreated, regardless of what other management practices are carried out (see *Reason to cheer* in *Rice Today* Vol. 3 No. 4, pages 12-17).

"This will allow us to determine what level of control is required for dealing with insect pests," Dr. Jahn

THE FARMSTEAD TRIAL assesses crop loss from pests to see if the intensified farming system leads to greater damage from insects such as stem borers, which sever the rice-bearing panicles and cause "white head," so-called because the grains turn white as they die.

THE BURNING OF THE RICE

Like many aspects of normal life in the country, agriculture in Cambodia was devastated during the reign of the Khmer Rouge. But, during the International Year of Rice 2004, just a few decades since the demise of the regime, Cambodia celebrated ten years of rice self-sufficiency. This remarkable recovery began when in 1985 IRRI was invited to work with Cambodian scholars and scientists to help re-establish the country's rural economy. Supported by funding from the Australian Agency for International Development, the venture was called the Cambodia-IRRI-Australia Project (CIAP) and was led by Australian agronomist Harry Nesbitt (see Rice Today *Vol. 1 No.1, pages 14-19). Scientist Don Puckridge, a member of the IRRI team sent to Cambodia, has chronicled the events that led to the rejuvenation of Cambodia's rice production in a new book titled* The Burning of the Rice. *The following excerpt from Chapter 2 describes some of the enormous challenges faced by the CIAP team when the project began.*



POPULATION AND RICE PRODUCTION, CAMBODIA 1961-2000

FROM "THE BURNING OF THE RICE" PAGE 179

"An enduring memory of Prey Veng Province was of a narrow dusty road on the bank of a canal drawn straight across the landscape. It was a typical example of Khmer Rouge changes to rice culture in which they dug canals to follow grid lines of a map without reference to the topography. A few diminishing pools of water along the bottom of the canal were a reminder of the futility of trying to keep the dry-season drought at bay. Another more fortunate canal was half full of muddy water, with a bamboo fence placed across it to trap fish as the water level dropped. Nearby were four substantial wooden houses on stilts, scattered as if they avoided associating with each other. Conical stacks of straw near each house were being undermined by bites from cattle taking respite from the dry and almost barren fields.

We stopped at a group of huts and saw an orphan girl of about sixteen years of age tending an earthen fireplace in the open, boiling sugar palm juice in a large wok to make palm sugar, a common ingredient in cooking for those who could afford it. Seeing this girl and other orphans in that place made more impact when we learnt that Prey Veng had over 34,000 widows and 10,000 orphans in a population of about 700,000. Seventy percent of the men had died under the five years of Khmer Rouge rule and sixty-five percent of the remaining population was female. Kampong Speu Province had 17,000 widows and 7,000 orphans, Kampong Chhnang Province 15,000 widows, and so on. In the sixteen to forty-five age group of Prey Veng Province, females outnumbered males by about three to one.

This disproportionate ratio of the sexes resulted in social disruption and lack of male muscle power for heavy farm work. Consequently, women were often obliged to perform tasks that were traditionally done by men, such as land preparation and application of farmyard manure and chemical fertilizer to crops. The loss of animals due to the effects of war, widespread disease and overwork took their toll as well. People without animals had to hire them, with payment usually in rice or labor, or to do the work by hand. On one occasion we even saw a young woman with a yoke over her shoulders straining to pull a plough while an old woman behind it guided the blade in the furrow.

A social survey a few years later found that such women had less access to animals and other resources, were the major borrowers of informal loans and had less access to information. Even though they may have been the only adult in the family, there was still the cultural perception that they were not farmers, but were helpers and housewives. In families without cattle or buffaloes for ploughing and raking of their fields, it was the women who were almost always the ones who repaid the labor owed as payment for borrowed draft animals. One morning of ploughing and raking was usually repaid by a full day of pulling seedlings and transplanting. Women who did not own animals also provided labor in exchange for cow manure for use as fertilizer on their fields and they were often exploited because they lacked cash or other assets."

explains. “It is generally assumed that there will be a significant crop loss from pests. This experiment will allow us to actually measure what percentage, if any, is lost when no pesticides are used in each system.”

Initial results of the no-pesticide trials show a 7% yield drop caused by pests in the intensified fields, but no significant loss in the conventional fields, indicating that intensification may increase levels of crop loss.

“While intensification increases yields,” says Dr. Jahn, “it also appears to increase the percentage of the total yield that is lost through damage by insect pests. There’s a trade-off, and we’ll perform an economic analysis to determine whether or not it’s financially worthwhile to control pests in the intensified system.”

Harvest help

Marie is one of the participating farmers. Her farm has a total area of around 1.5 hectares, in four separate fields, all of which are involved in the Farmstead trials — some as intensified fields, others she farms using her own methods. Her husband is a teacher at the local primary school and she has four children aged 12 to 17. The day we visited, her eldest son was harvesting rice along with two hired laborers. She told us that her younger children, who were at school, also help with the harvest on Sundays.

Marie’s farm presents a typical scene. All around, rice plants lie flat, as though blown over by a strong wind. Marie explains that she flattens them herself because the Phka Khnhei she grows is tall and difficult to harvest when the plants are upright. Bundles of rice, evidence of the day’s work, form curved rows and snake in winding paths to the laborers.

Marie pays her laborers 8,000 riels, just over US$2, per 100 rice bundles. They harvest approximately 800 bundles of Phka Khnhei per field, for a total labor cost of $16 per field. She sells her rice at 400 riels ($0.11) per kilogram and, with a yield of close to 2 tons, receives around $200 income from her harvest. With

EVIDENCE OF HARD WORK — bundles of harvested rice line the fields at the end of the day.

FARMSTEAD SCIENTISTS Gary Jahn (left) and Preap Visarto (middle) ask Marie about her experiences with the field trial.

Cambodia this year suffering from drought that has destroyed a fifth of the country’s wet-season crop, Marie may earn up to 600 riels per kilo. She is a long way from being wealthy but, as far as rice farmers go, Marie is doing OK. Much room for improvement remains, though, and by adopting Farmstead’s intensified system she stands to gain a better, more stable income to support her family. Importantly, she will also get a chance to farm other crops.

Although the system is proving successful, Dr. Jahn says that it may need to be linked with a microcredit or livelihood improvement scheme. “The farmers really like the system and can recognize the benefits it provides, but some farmers may need initial income to implement it — extra money to buy good seed, fertilizer and labor.”

The flexible approach the researchers are taking to Farmstead allows problems to be solved as they arise. One thing preventing widespread adoption of the IR66-Phka Rumduol combination is crab damage. Phka Rumduol is planted several weeks later than Phka Khnhei, leaving seedlings susceptible to attack by a particular type of crab that matures at the same time. Marie says this would prevent her from planting the two modern varieties in the lower-lying fields that the crabs inhabit. It is a dilemma for many farmers with low-lying fields in the area. In response, Mr. Visarto and Dr. Jahn plan to expand the Farmstead system to include a crab management strategy.

In its first year, Farmstead has shown that farmers have the potential to double their rice yield. Farmstead farmers, having observed the system’s benefits, plan to adopt the combination of modern varieties in their fields next season. As they improve their rice production, farmers can start to diversify their crops and their income, which ultimately means a better life for them and their families.

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