ACIAR

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ACIAR PROJECT NEWS

New cocoa project in Indonesia

To reduce threats of disease and pest losses in the Indonesian cocoa industry is the aim of project PHT/2000/012, Selection for improved quality and resistance in cocoa in Indonesia, for which a start-up workshop was held at the Agricultural Technology Assessment Institute (Balai Pengkajan Teknologi Pertanian (BPTP)) headquarters in Kendari, Sulawesi during June 2001.

Vascular-streak dieback, *Phytophthora* pod rot, and *Phytophthora* canker are the main diseases of the

Kendari Research Station, venue for the new cocoa project start-up workshop.

L–R: Dr Philip Keane, La Trobe University; Mr Arief Iswanto, ICCRI; and Dr Smilja Lambert, Mars Confectionary Australia inspect a cocoa tree plantation.

Cocoa pods: prone to attack by rots and borers.

cocoa tree (*Theobroma cacao*) in Indonesia. A very serious insect pest is cocoa pod borer (*Conopomorpha cramerella*), which is gradually spreading through the main cocoa-producing areas in Indonesia's eastern islands and is a threat also in West Papua and Papua New Guinea.

The new project will enhance the capacity of personnel in the Indonesian industry to collect, maintain, and screen for pest and disease-resistant cocoa genotypes.

The project builds on expertise in cocoa disease management developed over 15 years by the project partners from La Trobe and Melbourne universities working in collaboration with the Indonesian Coffee and Cocoa Research Institute (ICCRI), Dinas Perkebunan,

L–R: Dr James Kiaulo, CCRI; Dr David Guest, University of Melbourne; Dr Smilja Lambert, MCA; and Dr André Drenth, University of Queensland at the workshop.

BPTP Kendari, and PT Effem Indonesia, the last-named being a cocoa research and processing facility at Macassar that is part of the Mars corporation. The project will deliver benefits to cocoa smallholders in southern and south-eastern Sulawesi. A particular opportunity exists for strengthening linkages between BPTP, ICCRI, and Mars, Inc.

Others who attended part or all of the workshop included the Provincial Governor and the Director General of Indonesia's Agency for Agricultural Research and Development.The Director and two staff (a plant pathologist and a plant breeder) from the PNG Cocoa and Coconut Research Institute (CCRI) participated, auguring enhanced linkages between CCRI and ICCRI.

For further information about the project, contact Dr Philip Keane at <BOTPJK@lurac.latrobe.edu.au>.

[EH/GIJ]

IN THIS ISSUE

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GLOBAL POST-HARVEST FORUM

News from P*h*Action

Pushing forward the development of its "Linking farmers to markets" initiative was the main business at the 2001 annual meeting of P*h*Action, the Global Post-harvest Forum. The meeting was held in Montpellier, France during June.

There were over 40 participants, representing P*h*Action (see box below) and collaborating partner organisations, the Global Forum for Agricultural Research (GFAR), and other public and private sector organisations.

An earlier meeting involving several P*h*Action members and resource personnel from Vietnamese institutions, held in Hanoi during April, had crystallised ideas about the initiative and set the agenda for the Montpellier meeting. The inclusion of Vietnamese partner institutions in discussions was of great benefit in the generation of ideas and in program consolidation.

Madame Bui Thi Lan of the International cooperation Department of the Ministry of Agriculture and Rural Development outlined Vietnam's postharvest priorities to the meeting in Hanoi. She noted that while the country had made great strides in generating income from relatively low-value commodities such as rice, the government is now placing high priority on the development of exports with a higher proportion of value added, including processed products.

Participants in the April 2001 P*h*Action meeting in Hanoi. Front row, L–R: Mr Duong, Plant Protection Department (PPD); Rupert Best, CIAT; Marie Helene Dabat, CIRAD; Mrs Thuy, PHTI, Hanoi; Geoffrey Bockett, NRI. Back row, L–R: Nguyen Duy Duc, PHTI, Ho Chi Minh City; Christopher Wheatley, postharvest consultant, New Zealand; Shaun Ferris, IITA; Dai Peters, CIP, Hanoi; Rob Bakker, IRRI; Mr Huy, PPD; Jan van Graver, CSIRO; Ellen Hanak, CIRAD.

P*h*Action itself sees the retention in rural production areas of a proportion of the value added through postharvest processing and marketing activities as offering great scope for contributing to the goals of developing countries at a time when globalisation and other factors are rapidly changing the agricultural landscape.

"Linking farmers to markets"

"Linking farmers to markets" is an inter-agency program for the coordination of project activities in postharvest development. It includes four key themes:

- Identifying market opportunities
- Enhancing competitiveness of rural agri-enterprises
- Developing and disseminating postharvest technologies for rural industries
- Achievable standards in food quality and safety for smallholder enterprises.

Thematic analysis of current activities will allow donors to target critical gaps within a broad coordination framework and thereby maximise the impact of scarce R&D resources and avoid duplication.

A framework document describing the "Linking farmers to markets" initiative and the theme areas is in preparation.

Concluded at foot of page 3.

Participants in the P*h*Action annual meeting in Montpellier visited a local winery to look at value-adding in grapes.

About P*h*Action

P*h*Action is an organisation whose members are jointly concerned with the efficient, equitable and sustainable development of the postharvest components of agrifood systems, in order to assist governments and societies to reach their developmental goals. Given the changes that this sector is undergoing, P*h*Action is facilitating the conceptualisation and design of a portfolio of projects that will attempt to improve the ability of the postharvest sector to contribute to these goals.

P*h*Action was created in 1999 as a global postharvest forum whose mission is to:

- achieve recognition of the importance of and increase resource allocation to the postharvest sector in developing economies; and
- act as a platform for more effective and coordinated postharvest interventions.

P*h*Action brings together development and technical assistance organisations, and constitutes an integration of the institutions that made up the Group for Assistance on Systems relating to Grain After-harvest (GASGA) and five International Agricultural Research Centers (IARCs) belonging to the Consultative Group for International Agricultural Research (CGIAR).

At present, P*h*Action members include ACIAR, Centre de Coopération Internationale en Recherche Agronomique pour le Développement (France) (CIRAD), Centro Internacional de Agricultura Tropical (CIAT), Centro Internacional de la Papa (CIP), Deutsche Gesellschaft für Technische Zusammenarbeit (Germany) (GTZ), Food and Agricultural Organization of the United Nations (FAO), Institute of Crop and Food Research (New Zealand), International Food Policy Research Institute (IFPRI), International Institute for Tropical Agriculture (IITA), International Rice Research Institute (IRRI), Japanese International Research Centre for Agricultural Sciences (JIRCAS), and Natural Resources Institute (UK) (NRI).

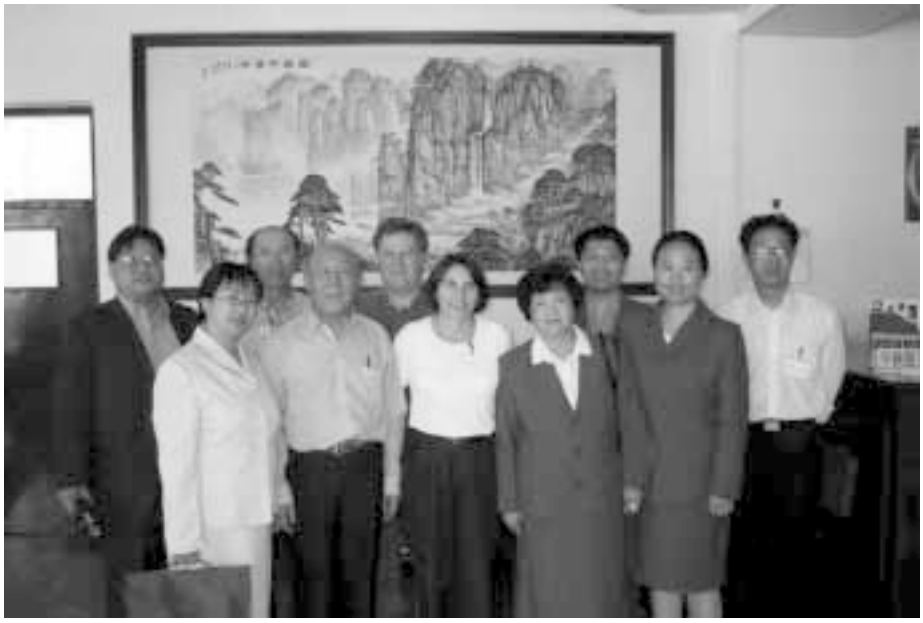
New melon research proposed for China and Australia

ACIAR Small Project PHT/1996/152, completed in mid 1999, identified the major causes of postharvest melon losses in China as weight loss during transport and the development of fungal rots caused mainly by species of *Alternaria*, *Fusarium*, *Rhizopus*, and *Trichothecium*. Rough handling, poor packaging, and lack of suitable postharvest treatments to control diseases were at the root of these problems.

The losses involved can be very high. The project found that losses through disease accounted for 30–50% after the melons had been transported from the production areas in Gansu Province, northwestern China to distant markets on the east coast, but could be as high as 80% in extreme cases. Higher losses were observed in susceptible varieties and when melons were handled roughly after harvest.

Now a new project, to be coordinated by Dr Robyn McConchie of the University of Sydney, is being developed to tackle these problems. Its results will be applicable to not only China's melon industry but also to postharvest handling of a range of cucurbits (pumpkins, cucumbers, melons etc.) in Australia.

As in the earlier project, Professor Ma Keqi of Gansu Agricultural University will coordinate work in China, which will also involve researchers from the China Agricultural University, Xinjiang Department of Agriculture, and Xinjiang University. In Australia, Dr Stephen Morris of the Sydney Postharvest Laboratory (CSIRO) will work with Dr McConchie and others from the University of Sydney.



Chinese and Australian melon researchers met in Beijing in May, during an ACIAR-cosponsored international workshop on postharvest handling of fresh vegetables. L–R: Associate Professor Chen Fahe, Xinjiang Agricultural University; Ms Li Yazhen, Hetao University; Professor Ma Keqi, Melon Research Institute, Gansu Agricultural University (GAU); Professor Tang Wenhua, CAU; Dr Stephen Morris, Sydney Postharvest Laboratory; Dr Robyn McConchie, University of Sydney; Professor Wu Fangwen, Melon Seed Section, Xinjiang Department of Agriculture; Dr Zheng Shufang, Beijing Vegetable Research Center; Professor Yanrong Zhang, GAU; Associate Professor Chen Nianlai, GAU.

The proposed new project (PHT/1998/140: Postharvest handling and induced mechanisms of disease control in melons and other cucurbits) would cover three areas:

- strategies for the use of postharvest treatments that boost natural defence mechanisms in melons and postharvest treatments to control disease and maintain quality;
- development and testing of technologies that can be used during storage and transport to improve supply-chain management; and
- promotion of improvements in the melon industry through liaison and training involving farmers, marketers, and government agencies.

Targeting the first of the above objectives, a range of new treatments including activators and regulators of systemic resistance, such as benzothiadiazole (BTH) and jasmonic acid, respectively, and new fungicides such as the strobilurins will be field-tested to compare efficacy and application rate and timing in a range of growing areas.

At the workshop on postharvest handling of fresh vegetables held in Beijing during May (see PH Newsletter No. 57), Dr Zhang Liqun of the China Agricultural University, Beijing presented, on behalf of several authors, the results of research on the use of BTH to protect melons from disease. The researchers found that application of BTH reduced the incidence of powdery mildew diseases. Furthermore, melon plants treated with BTH had fruit that ripened one week earlier than fruit from untreated plants and provided a higher economic return.

On a broader front, the project will draw on systems assessment methods and participatory approaches to build postharvest systems research capacity in China.

[RMcC/EH]

P*h*Action news ... from page 2

In the interim, further information can be found in the latest P*h*Action newsletter at <http://www.iita.org/info/phnews4/content.htm> or in ACIAR PH Newsletter No. 56.

Participants in the Montpellier meeting resolved that the initiative should be presented at the next Annual General Meeting of the Consultative Group on International Agricultural Research, to be held in Washington in October 2001. Opportunities for linkages with other activities such as those of GFAR, CGIAR, and the FAO "Global initiative on post-harvest technology" (see item on page 12) are being explored.

New Zealand's Institute of Crop and Food Research of New Zealand was welcomed as a new P*h*Action member at the June meeting.

[EH/GIJ/CW]

Impact of ACIAR postharvest research in Thailand

ACIAR's Impact Assessment Program recently published the results (Isvilanonda et al. 2001) of an assessment of 49 Thailand/ACIAR collaborative projects funded by ACIAR during 1983–1995.

All the assessments were conducted by a team from the Faculty of Economics, Kasetsart University, Bangkok headed by Associate Professor Somporn Isvilanonda. There were three postharvest projects among them; a summary of the findings on these follows.

Controlled atmosphere grain storage

The reviewers assessed that Project PHT/1983/007 — Long-term storage of grains under plastic covers — has provided benefits to Thailand in the form of scientific knowledge, technology transfer (used by rice handlers), training, and publications. The project demonstrated and promoted the use of carbon dioxide (CO_2) atmospheres for long-term storage of milled rice in sealed bag-stacks. While this technology has not been adopted for larger-scale storage of grain, mostly for reasons related to cost and efficiency, it has been taken up for preserving quality and extending the shelf life of consumer-size (e.g. 2 kg) plastic packs of "cargo" (brown) rice. Nevertheless, there is some indication that vacuum technology may replace the CO_2 fumigation technique in the near future in that market.

In their ex-post economic evaluation, Acharee Sattarasart and Somporn Isvilanonda estimated that the net present value of the technique over a 30-year time frame is $359,757, giving an internal rate of return of 15.6%, suggesting that the investment in the project was worth while.

Integrated pesticide use in grain storage

Project PHT/1986/009 — Integrated use of pesticides in grain storage in the humid tropics — sought to transfer technology developed and successfully applied in Australia for the protection of stored grain from insect pest attack. The project ran in Malaysia and the Philippines as well as in Thailand.

Suwanna Praneetvatakul's assessment of the project concluded that, while it had brought significant benefits to the other countries involved, the potential benefits for Thailand had not been realised. The technology has not been adopted in Thailand for the simple reason that there is no system there for registering for use the chemicals applied in grain storage. The benefits of the project to Thailand are thus restricted to enhanced researcher and farmer knowledge about the prudent use of chemicals for insect control in grain storage, and as a starting point for other research projects. While these benefits may be significant, it is not possible to value them in monetary terms.

Fungi and aflatoxin projects

Acharee Sattarasart and Somporn Isvilanonda assessed two ACIAR-supported projects in this area of work: Project PHT/1988/006 — Fungi and mycotoxins in food and feed stuffs; and Project PHT/1991/004 — Factors affecting invasion by *Aspergillus flavus* and aflatoxin formation in Asian peanuts. They note that, so far, no new technology for solving the problem of fungi and aflatoxins in agricultural products at field level has emerged from the projects. The projects have, however, yielded basic scientific knowledge that has permitted a true assessment of the extent of the mycotoxin problem and provides a foundation for further studies. Benefits have already flowed to participating countries in terms of training, which has been identified as a primary factor in addressing fungi and mycotoxin problems in the developing countries of the region.

While a previous economic analysis (Lubulwa and Davis 1996) found the potential benefits of the projects to be high, the current assessment finds that, from the Thai point of view, potential project benefits have been curtailed by limited follow-up of the projects. This is especially evident in the areas of collaboration with researchers in other countries in developing a computer database of fungi significant in Asian commodities, and feedback from Australian partners about data collected in field experiments.

The problems of aflatoxins in foods and feedstuffs in Thailand remain in urgent need of attention, on both economic and health grounds.

In Australia, PHT/1991/004 laid the foundation for work funded by the Grains Research and Development Corporation that has demonstrated the potential for using non-toxigenic strains of *Aspergillus flavus* in the management of aflatoxins in peanuts.

Comment

All the projects discussed here involved collaborations between multiple partners, but the focus of these assessments is their impact on Thailand. There is no doubt that the projects all generated valuable outputs, and their overall economic worth has been demonstrated. However, their specific benefits to Thailand have been less impressive, mainly because either the results have not been adopted, or the projects have not been followed up adequately. Obviously, if a transferred technology is not adopted, the potential benefits of the project are massively curtailed. This problem needs to be carefully considered and researched during project planning (see article on page 8), e.g. could the Thai Government's failure to introduce an appropriate registration system for insecticide use in grain storage have been predicted? The problem of unsatisfactory project follow-up frequently occurs as scientists move to different projects after project completion, and is difficult to overcome under current funding arrangements. Another factor to consider is that postharvest technologies and practices in collaborating countries are seldom static. For example, since the end of Project PHT/1986/009 (the pesticide project) there has been, in Australia and elsewhere, a strong move away from the use of residual chemicals for the protection of stored grain, towards the adoption of newer, more cost-effective and environmentally friendly techniques.

References

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[MW/EH]

FOOD SAFETY

New concerns on food-borne mycotoxins

Mary Webb

A FAO/WHO committee recently assessed the evidence on a range of fungal toxins found in common foodstuffs.

Mycotoxins are a global problem. Few would argue with that, but as more and more evidence accumulates so too do perceptions of the sheer magnitude of their impact on human health. Indeed, some authorities now believe that, apart from food security, the single most effective and beneficial change that could be made in human diets around the world would be the elimination of mycotoxins from food (see Pitt et al. 2000).

The significance, identification, classification, occurrence, prevention and detoxification of mycotoxins are being increasingly studied and reported. As mycotoxins are produced by a range of fungal species, efforts to minimise growth of these fungi, both pre- and postharvest, can reduce the risk of contamination. Means of achieving this include good agricultural practice, plant breeding for resistance to fungal attack, genetic engineering, proper grain drying, and appropriate storage. Detoxifying contaminated products is a "second best" option, generally aimed at producing animal feed only. The *Postharvest Newsletter* has published several articles on mycotoxins in recent years (e.g. see issue Numbers 51, 54, and 55). Although mycotoxins affect a wide range of animals, including those raised by humans for meat and animal products and other purposes, in this report we focus on their implications for human health.

In February 2001, a meeting of the Joint FAO/WHO Expert Committee on Food Additives focused on assessing and characterising the risks associated with consumption of foods that may be contaminated by various mycotoxins (FAO/WHO 2001). The mycotoxins scrutinised at this meeting were aflatoxin M_1, fumonisins, ochratoxin A, and three trichothecenes — deoxynivalenol (DON) and the T-2 and HT-2 toxins. Their fungal sources are shown in the table below.

The Committee assessed these mycotoxins using the five Global Environmental Monitoring System/Food Contamination Monitoring and Assessment Programme (GEMS/Food) regional diets. The five regions identified in this system are the Middle East, the Far East, Latin America, Africa and Europe. For each toxin, the report (FAO/WHO 2001) gives an introductory explanation, followed by a detailed summary of findings on metabolism, toxicological studies, observations in humans, analytical methods, sampling protocols, effects of processing, food consumption/dietary intake assessment, prevention and control, and evaluation.

Aflatoxin M_1 is cytotoxic, genotoxic, and carcinogenic (causing liver cancer). It is produced by conversion from the more toxic aflatoxin B_1 through lactation and is primarily found in milk and dairy products. Highest contamination levels were found in Far Eastern samples, but people in this region generally consume little milk. After analysing the data, the Committee concluded that even with the worst-case assumptions, the additional risks for liver cancer predicted with use of the proposed maximum levels of aflatoxin M_1 are very small, even with big milk drinkers. The Committee reiterated its previous conclusion that, because of evidence that the hepatitis virus synergises the toxicity of aflatoxins, the liver cancer burden might best be reduced by giving priority to hepatitis B virus vaccination campaigns and to prevention of hepatitis C virus infection.

Fumonisins had not been previously evaluated by the Committee. They assessed fumonisins B_1, B_2, and B_3, although most of the data available were for fumonisin B_1. The toxicological profiles for all three are similar. Maize is the food most frequently contaminated by fumonisins. In 1993, WHO's International Agency for Research on Cancer (IARC <www.iarc.fr>) classified the toxins from *Fusarium moniliforme* (the main fungal species involved) as possible human carcinogens (Group 2B). The liver and kidney are prime targets, and there is evidence of a link to oesophageal cancer.

The Committee allocated a group provisional maximum tolerable daily intake (PMTDI) for fumonisins B_1, B_2 and B_3, alone or in combination, of 2 mg/kg of body weight. Using GEMS/Food regional diets data, people in the African region consume more than this level (at 2.4 mg/kg body weight per day) based on mean levels of maize contamination. Even more worrying, however, is that fumonisin levels fluctuate greatly and using estimates of contamination at the higher end of the scale (90th percentile), four out of five regions exceed the PMTDI (all but Europe), with Africa reaching an alarming 7.3 mg/kg of body weight per day.

Ochatoxin A (OA) is nephrotoxic. It is also immunosuppressive, affects embryos, and IARC has classified it as a possible human carcinogen (Pitt 2000). It has been detected in cereals, wine and grape juice, beer, and coffee, and can be transferred to meat and milk when animals eat mouldy grain. The Committee retained the previously established provisional tolerable weekly intake (PTWI) of 100 ng/kg of body weight, pending the results of studies in progress.

Mycotoxins	Fungal source(s)
aflatoxin M_1	*Aspergillus flavus, Aspergillus parasiticus,* and the rare *Aspergillus nomius*
fumonisins	At least 12 *Fusarium* species, the most significant being *F. verticillioides* (= *F. moniliforme*) and *F. proliferatum*
ochratoxin A	*Penicillium verrucosum, Aspergillus ochraceus* and related species, and *Aspergillus carbonarius* together with some isolates of *Aspergillus niger*
deoxynivalenol	*Fusarium graminearum* (*Gibberella zeae*) and *Fusarium culmorum*
T-2, HT-2	*Fusarium sporotrichioides, Fusarium poae, Fusarium equiseti* and *Fusarium acuminatum*

(Source: FAO/WHO 2001)

Continued at foot of page 6.

FORTHCOMING MEETINGS

8th IWCSPP — it's time to register

The organising committee for the 8th International Working Conference on Stored-product Protection, to be held in the historic city of York, UK from 22–26 July 2002, has released the second announcement for the conference. It can be viewed, along with other conference details, at <www.icscs.co.uk/iwcspp2002 >.

The overall theme of the 8th IWCSPP is "Technology into action". The main topics to be covered are:

- **Biology, detection and biological control** — Biology of invertebrate and vertebrate pests and fungi; Sampling and trapping; Biological control; Relevance to integrated pest management.
- **Food safety —** Pesticide residues; Mycotoxins and other contaminants; Product quality determination; Quarantine and regulatory issues; Risk assessment.
- **Chemical and physical control systems** — Fumigation and controlled atmospheres; Conventional pesticides; Natural pesticides including plant derivatives; Inert dusts; Physical control methods.
- **Processing and applications** — Food processing and added value; Storage systems (including engineering); Technology transfer and extension systems; Modelling of storage systems.
- **The future of stored product protection: impacts of global issues** — Trade liberalisation; International standards; Food supply and demand; Coordination of research; Genetically modified organisms; Impacts in different economic regions.

Also, the organisers are encouraging the presentation and discussion of some **newer topics**, such as molecular biological approaches, high value crops, novel crops, and genetically modified crops.

Proposed workshop topics include:

- Stored products information on the Internet
- Living without methyl bromide
- Diagnostics
- Food hygiene and health

A **trade exhibition** will complement the scientific program.

In a break with arrangements at past conferences, the core program will be divided between plenary lecture sessions on major issues relating to the key themes, and poster sessions that will be given more prominence as discussion forums for new findings. Poster abstracts will be published in the proceedings. All authors will be encouraged to address the conference theme.

ACIAR regrets that it has no funds available to sponsor participation in the conference.

[EH]

Postharvest at IHC2002

"Issues and advances in postharvest horticulture" will be the topic of 1 of 23 symposia on the program of the 26th International Horticultural Congress and Exhibition (IHC2002) to be held in Toronto, Canada on 11–17 August 2002. Convened by Prof. Errol Hewitt of Massey University, New Zealand and Dr Robert Pange of AAFC, Kentville, Nova Scotia, Canada, the topics for the seminar are: Postharvest technologies for the developing world; Genomics in postharvest science — applications and expected benefits; Phytonutrients — postharvest science to improve human health and life quality; Postharvest pathology and biocontrol of diseases. For full information about the congress and its program go to <www.ihc2002.org>.

New concerns on food-borne mycotoxins ... from page 3

They also called for investigation into sampling procedures, surveillance, epidemiology and the occurrence and ecology of the fungi that produce OA, especially in fresh produce, in order to allow better evaluation of the significance of this mycotoxin.

Trichothecenes are predominantly found in grains and can cause loss of appetite, vomiting, lesions in the intestinal tract, immunosuppression, lethargy and ataxia when consumed as food contaminants (Pitt et al. 2000). The FAO/WHO Committee evaluated three of these toxins: deoxynivalenol (DON), T-2 and HT-2. They considered the last two together, as HT-2 is a metabolite of T-2 and their toxic effects could not be differentiated. T-2 toxin is a potent inhibitor of protein synthesis. The Committee agreed to a PMTDI of 60 ng/kg of body weight per day for T-2 and HT-2 toxins, alone or in combination. Data were available for only the European region, and although consumption fell below the PMTDI in this region, the need for more accurate information from other parts of the world and for improved analytical methods was emphasised.

In general, more data on the occurrence of DON (also known as vomitoxin) in food products are required for better estimates of intake. The Committee established a PMTDI of 1 mg/kg of body weight. Ingestion of DON at this level would not affect the immune system, growth, or reproduction, but lack of data meant that the Committee could not establish a level below which no acute effects would be expected to occur. Estimation of the dietary intake of DON resulted in values that exceeded the PMDTI for four of the five regional diets.

Overall, these findings present a grim picture for human health. Of the mycotoxins studied, the Committee's findings show only aflatoxin M_1 to be within tolerable limits of consumption. Available data show that PMDTIs are exceeded for fumonisin and DON, and further testing and information gathering could well conclude that dangerous levels of T-2/HT-2 and OA are being ingested.

Sources

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DIGEST OF CONFERENCE PAPER*

Rice quality management

The demand for higher quality rice is increasing with the growth of economies in the South-east Asian region. In many countries, however, the quality of milled rice is low, a result of inappropriate management techniques in all aspects of grain handling, including harvesting, threshing, drying and milling.

The objective of a grain quality management program or campaign should be to minimise quality and quantity losses at every link of postproduction chain, recognising that it is a "downhill slope" after harvest. The postproduction system in Asia is complicated by the involvement of multiple parties and highly fragmented rice production. In the production–to–consumption chain there are numerous players: farmers, contractors, agents, traders, processors/cooperatives, wholesalers, retailers and consumers. A village in Laguna Province (Philippines) provides a potent example of the complexity of the chain: one season's worth of rice was produced by 45 rice farmers and procured by 37 different middlemen for distribution — i.e. a total of 82 individual decision-makers, each with their own knowledge and incentive to consider quality, handled the grain even before it was passed to a processing point.

There has been little emphasis on quality management in the postproduction sector to date, and many key players in the sector remain unaware of even the general principles for maintaining grain quality, the majority of which relate to a single factor—grain moisture content. Ways in which this factor can be optimised include: mechanical threshing at 20–24% moisture content (m.c.) to prevent grain damage; timely drying to 14% m.c. to minimise grain spoilage; and by avoiding reabsorption of moisture during storage to prevent fissuring. In their thought-provoking paper, Mark Bell and co-researchers at the International Rice Research Institute use four examples, taken from Thailand, Cambodia and the Philippines, to examine the value of rice quality improvement programs in increasing awareness and education, and the problem of the current lack of incentive for participants in the sector to consider quality.

Harvesting in north-eastern Thailand

Rice farmers in north-eastern Thailand indicated that they were losing income because of unacceptably high levels of broken grain as a result of inappropriate threshing. The farmers blamed contractors for using their threshing machines at too high a speed in order to maximise their profits by doing the job as quickly as possible. This turned out to be wrong: the problem lay in the rice being threshed at a moisture content that was too low—12–15% instead of the acceptable range of 20–24%. The farmers' perception of the right moisture level for threshing was incorrect, and probably stemmed from the days of manual threshing when lower moisture contents were indeed more suitable for threshing. This example highlights the need for appropriate education to accompany the introduction of new technologies.

Drying in the Philippines

The adoption of mechanical dryers for rice has not kept pace with increased rice production and growing demands for higher quality rice among urban consumers in the Philippines. The main problem seems to be a lack of incentive to produce higher quality rice—there is generally no price difference between mechanically dried and sun-dried paddy. This leads to the perception among users that mechanical drying is uneconomical, as increased grain quality is not accounted for in the comparison of different drying methods. Adding to the lack of incentive are the facts that: (1) there is actually a market for wet grain in the Philippines, and (2) there is a lack of knowledge among users on proper dryer operation.

In the past, dryer introduction programs have been unsuccessful because they have been too narrowly focused on farmers and cooperatives. They should also include traders and millers as potential beneficiaries of their programs. This has been recently illustrated by the successful adoption of a number of small recirculating grain dryers imported from Taiwan and Korea, partly as a result of aggressive promotion by their suppliers who offer lenient payment schedules to their prospective owners. A recent user survey found that the primary reasons for adoption of these dryers were their reliability and the lack of labour for sun drying.

Milling in Cambodia

Rice milling in Cambodia is done at the village level or at commercial mills. A recent survey found that milling recovery and head rice yield are low and highly variable.

At the village level, milling recovery is very low, with milled rice having a high degree of broken grains. Because payment is made through the retention of by-products by the millers, it is not in the millers' interest to improve milling recovery, as it would reduce their revenue. Furthermore, the amount of whole kernels in milled rice is of little importance to the rural families that are serviced by such mills.

The commercial mills process rice for larger urban or export markets. There is much room for improvement in both performance and maintenance of existing machinery in these mills, and together with monitoring grain moisture levels, head rice and milling recovery could be greatly enhanced. To this end, efforts should concentrate on raising awareness of these issues among commercial millers.

Quality standards and grades in the Philippines

While technical feasibility can repeatedly be shown, economics will rule the adoption of improved practices that maintain quality. In this respect, determining adequate standards and grades with respect to consumer needs is required. A standard is a quantitative way of measuring and comparing quality criteria. Based on this standard, rice is graded. The objectives of such grading are to:

- ensure only edible rice reaches the consumer;
- improve postproduction practices so as to eliminate or reduce losses;

Continued on at foot of page 8.

* Bell, M., Bakker, R.R., de Padua, D.B. and Rickman, J. 2000. Rice quality management—principles and some lessons. In: Johnson, G.I., Le Van To, Nguyen Duy Duc and Webb, M.C., ed., Quality assurance in agricultural produce. Proceedings of the 19th ASEAN/1st APEC Seminar on Postharvest Technology, Ho Chi Minh City, Vietnam, 9–12 November 1999. ACIAR Proceedings No. 100, 255–263.

FEATURE ARTICLE

Delivering better help to farmers*

John Bagshaw and Graham White

It is important that research outputs are adopted by their intended users — otherwise, what was the point of the research? ACIAR's strategic planning activities are highlighting the increased emphasis on observable uptake of research outputs by rural communities in the countries in which ACIAR collaborators work and in Australia.

Successful adoption of research results starts with all people involved having this objective as a core personal value — influencing the way we think, plan, and act in our project work.

In this article, we present some issues and ideas aimed at improving adoption. Given the complexity of the subject matter, we cannot hope to provide a full treatise but rather a few salient points to stimulate thinking.

* This paper was first presented at the 2000 annual meeting of the ACIAR Postharvest Technology Program, held at Gatton, Queensland last December. John Bagshaw is a Senior Extension Horticulturalist at the Horticulture Institute, Queensland Department of Primary Industries, 80 Meiers Road, Indooroopilly, Queensland 4068. Graham White is the Senior Program Extension Officer at the Farming Systems Institute, Queensland Department of Primary Industries, PO Box 102, Toowoomba, Queensland 4350.

Approaches to improving adoption of technologies/ information

"Extension" is the term commonly used by agriculture service organisations as a catch-all for methods to improve adoption of technology or information.

Extension is still regarded by some as an information distribution process to have the project outputs — usually some new technology — adopted at the end of a project. It is a one-way process between the intervention agency and the target group. This perception is usually seriously flawed and rarely results in good adoption.

A better approach is to engage with the target group before planning a project, to find out their problems, needs, and perceptions. The project can then be designed and conducted so that the outputs, and the way they are packaged, suit this target group. This is very much a two-way communication process.

Van den Ban and Hawkins (1996) have pointed out: "Extension information will be effective only if it fits into the farmer's decision making process and is compatible with their way of thinking. ... The extension agent must be oriented primarily towards the farmer's problems as the farmer perceives them, and not towards agricultural technology."

Problems with "diffusion"

Diffusion processes are widely used to reach a larger number of people. These usually involve intervention agents working with progressive farmers to try out and use new technologies or innovations. The diffusion theory is that new ideas diffuse from the progressive farmers to others in their community. This works to a certain extent, but it has limitations:

- In a competitive marketplace, the progressive farmers may be reluctant to share their newly found competitive advantage.
- Progressive farmers may be better educated, be better managers, and have more access to resources, so technologies or new ideas that work for them may not be appropriate for (and so adopted by) the less-progressive farmers. As a result, innovations may benefit those who know best how to look after themselves and neglect those who most need assistance.

The diffusion concept assumes that new ideas/technologies are equally relevant to all members of a community. This automatically makes non-adopters into laggards and emphasises lack of knowledge and motivation as the main cause of non-adoption instead of, for example, lack of access to resources. It also highlights the need to differentiate target groups, and to adapt technologies and information for each group.

Simple versus complex technologies

Simple-to-use technologies usually have higher rates of adoption.

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Rice quality management ... from page 7

- improve processing practices for better milling recoveries and for market expansion; and
- protect consumers from price or quality manipulation.

If designed and executed properly, such a system could benefit all the players in the postproduction chain.

Although the Philippines officially uses a grading system similar to that of the United States, a study of rice from retail markets in Laguna Province and Manila showed poor quality of milled rice, regardless of whether or not the rice had been graded. That is, the system is not working. In addition, on the domestic market, traders often falsely market their rice under respected local names regardless of its true type and quality, thus deceiving their customers.

Therefore, relevant, objective standards in the domestic market—that can be readily identified by farmers, traders, and consumers—need to be developed in the Philippines as an integral part of successful quality management.

Conclusions

Mark Bell and co-workers conclude that the success of quality management programs will depend on (1) improving the knowledge gaps that exist among key players in postproduction with respect to grain quality, and (2) ensuring that there are adequate incentives for all those involved to maintain the highest possible quality. Tied to these issues are:

- the need to look carefully at the most appropriate ways to present new knowledge—research strategies are evolving towards better needs assessment of the key players in the postproduction sector, and finding new ways to package and deliver information to them; and
- major improvements in grain quality can be expected only if the market develops the demand and is prepared to pay higher premiums for higher quality rice.

[MW]

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They are like a part of a motor: they replace an old part with no change needed to the rest of the engine, and require no extra skill or knowledge by the driver. An agricultural example of this type of technology is improved varieties of plants requiring no extra cultural skills. Clients like this type of technology because it requires minimal or no change on their part.

One strategy of researchers may be to focus only on this type of technology or to design simplicity into technology (if appropriate) — or at least identify to what extent a piece of technology is like this, then plan project activities accordingly.

But most new technologies (and all improved practices) do require change — and change is naturally resisted by nearly everyone. So there is a need to identify what changes will be needed to achieve adoption, what may be the barriers to change, and how to help the target group overcome them.

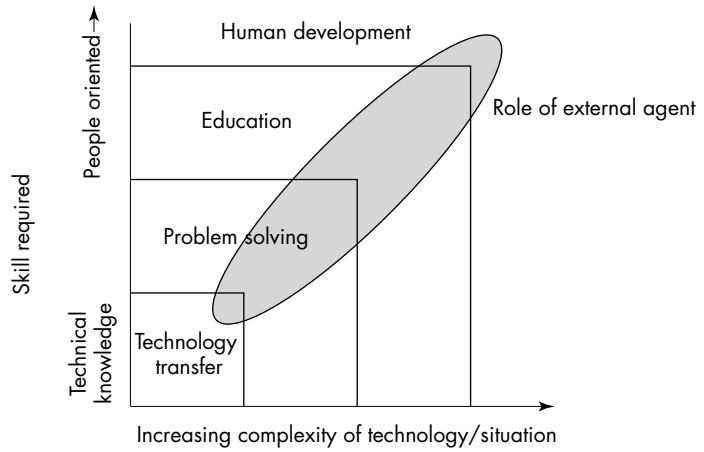
Clark et al. (1997) suggest that change in some or all of attitudes, aspirations, awareness, understanding, skills, technology, and resources may be needed to enable change in a practice to proceed. Different approaches may be necessary depending on which elements of change need to be addressed.

Intervention skills

As technologies become more complex to use, the types of skills required by those involved in helping target groups to adopt the technology change from technical knowledge to more people-oriented skills. The diagram at the top of the page shows the types of intervention skills required as the complexity of technologies or situations increases.

Technology transfer relates to technologies developed in isolation from the target group then transferred to the target group by communication techniques such as written information, field days, demonstrations, and so on. It is appropriate if technologies are relatively simple to use, or designed to be so, and are consistent with the goals and values of target groups.

Problem solving involves studying the target group, identifying problems and needs, then solving the problem through research or extension techniques.



Relationship between the types skills required for technology transfer and the complexity of the technology involved

Education provides the target group with skills and knowledge about the technologies to be adopted so they understand the underlying principles and can identify and solve their own problems without relying on external intervention agencies.

Human development includes a whole suite of supports depending on the situation. It could include training and support in leadership, conflict resolution, group development, change management, staff management skills, estate planning, information seeking, resource accessing skills, and so on.

Any or all of these intervention skills may be needed to achieve a reasonable level of adoption.

Key points for adoption of technologies

Clearly identify stakeholders and target groups

Stakeholders and target groups in ACIAR projects could include:

- scientific peers, who set the context for the scientific worth of the research;
- partner country governments, whose view of collaboration with Australia may affect bilateral relations;
- partner country research institutions, whose capabilities in a relevant area of research may be developed through the project;
- all or part of the marketing and supply chain for a particular commodity; and/or
- the farmers who produce the commodity, and the communities in which they operate.

In any project, all target groups and the objectives for those target groups should be clearly identified. If farmers are a target group and the project aims to aid farmers by developing an essential research capability, the links between the research institutions and farmers should be critically examined, along with the extension capability of the research institution or partnerships they can develop with other extension-oriented institutions.

No target group will be homogeneous. Different players within a target group may have to be identified and treated differently.

Situation/needs analysis

Finding out the problems, needs, and perceptions of the target groups early in the planning phase of a project is an essential step. This is a serious research issue in itself. Unless the project is developed within this context, the research may be off-track, and no amount of "extension" will bring about adoption.

Some of the techniques that can be used include surveys, interviews, workshops, focus groups, and rapid or participatory rural appraisal. None of these techniques will provide the complete definition of the context for a project, but they can capture some of the essential background.

Skill and experience are needed to use these techniques effectively, just as in the techniques of scientific research.

Ongoing two-way communication

From the situation analysis, through planning and execution of the project, to implementation of project outputs by the target group, two-way communication with the target group is necessary. This process gives the researcher further critical information about the needs and perceptions of the target group. It also provides the

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target group with the opportunity to keep the project relevant to their needs, and so increases their ownership of the outputs.

Develop target groups into active users of technology/information

Röling (1990) discusses four aspects of intervention that have proven to be successful in developing the capability of user groups to become more active users of technology and information:

- *Mobilisation* — increase awareness of the external innovation and how it might fit in the local context (financial, social, cultural) and existing knowledge base.
- *Organisation* — the local community and technical support agencies need to be organised into a self-supporting structure that will enable as many participants as possible to be involved in embedding new technologies or ideas into local businesses and community life.
- *Training* — individuals in the target groups need to be trained in the use of new technologies or ideas, as will local support people so they can provide ongoing service to the local community. Training may also include human development topics or other issues as needed for each situation.
- *Technical support* — local groups and support people usually require technical support related to new technologies from a research/extension agency.

These four functions work as an articulated mix, and any intervention requires all four for the intervention to be successful.

Suggestions from meeting participants

Participants at the ACIAR Postharvest Technology meeting provided suggestions on "ways to improve uptake of project outputs" based on their own experiences. These suggestions are summarised below:

At the start of the project:

- analyse problems and needs without bias;
- identify target groups, key agents of change, and industry champions;
- select appropriate partner institutions, who may be nongovernment or commercial organisations; and
- be aware that more rapid project development may increase relevance.

Throughout the project:

- involve end users, customers, and extension staff in two-way communication;
- take cultural sensitivities into account, do not be patronising; and
- build trust and ownership.

At the end of the project:

- run a debriefing workshop for stakeholders;
- highlight economic, health, and other benefits of the technology;
- analyse the risks of change versus benefits;
- demonstrate utility through hands-on training;
- legislate for compliance;
- do not rely on a single strategy for adoption; and
- apply quality control to the delivery process, with a "neutral umpire" to balance researcher bias.

This list indicates the high level of awareness by ACIAR researchers of the issues involved in promoting adoption of technologies to target groups. It also highlights that the "extension" role is the responsibility of all people involved in ACIAR projects, not just those labelled as extension specialists.

References

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Röling, N. 1990. Extension sciences: information systems in agricultural development. Cambridge, Cambridge University Press.

Van den Ban, A.W. and Hawkins, H.S. 1996. Agricultural extension, 2nd ed. Oxford, Blackwell Science Ltd.

TECHNICAL NOTE

New phosphine generator*

A new, wax block formulation that allows the immediate or controlled continuous release of phosphine has been developed by the Stored Grain Research Laboratory in collaboration with United Phosphorus Limited (UPL) in India and AusBulk Limited in South Australia.

A global licence has been granted to UPL to develop and market the new wax block formulation and generator patented by CSIRO.

The specially formulated wax block is impregnated with aluminium phosphide. When the block is in direct contact with water, phosphine is released. The controlled reaction of aluminium phosphide with water is enclosed in a special reaction chamber or generator. Health and safety problems with current application practice are also reduced because the generator will be at ground level and will retain all reaction residues for safe and easy disposal.

Phosphine-generator reaction chamber.

Existing commercial preparations rely on the reaction of aluminium phosphide with moisture in the grain bulk to produce phosphine, and the release of the fumigant is often slow and uncontrolled. Aluminium phosphide preparations also have inherent problems with residues and potentially unspent formulation remaining following the fumigation. Because of the high risk of explosion, water should never be added to existing aluminium phosphide formulations to speed up the release of phosphine.

The phosphine generator is currently being put through commercial-scale field trials in South Australia and New South Wales to evaluate its performance under Australian conditions. The current model of generator is capable of delivering either 5 or 10 grams of phosphine per hour over 16 days. The higher rate will be used at both trial sites. The NSW trials will enable further design development of the generation system for future use in horizontal sheds and larger manifolded vertical systems, where phosphine production rates of up to 160 g/hour are required. It will be several years before the new phosphine generator is commercially available, but it is an exciting development for grain storers. ■

* This article by Colin Waterford was first published in the August 2001 issue of *Stored Grain Australia*, newsletter of the Stored Grain Research Laboratory.

CURRENT AWARENESS

NEWS

Training courses at NRI

The Food Security Department at the Natural Resources Institute, University of Greenwich, UK will be offering two postgraduate diploma/MSc programs on postharvest topics during 2002: **Grain storage management** and **Postharvest horticulture**.

Training is provided by tutors currently working in international consultancies and research and development throughout Africa, Asia, and Central and South America.

Both courses are available in either "in attendance" or "distance learning" modes. The former is a 16-week, highly intensive PGDip program at NRI in the UK, followed by an MSc research project, usually conducted in the student's home country. Course dates are: PGDip, 11 March to 28 June 2002; MSc, 1 July 2002 onwards.

Distance learning is delivered via the Internet to your office or home computer, enabling you to study at your convenience. Active participation between students from around the world is encouraged through discussion group exercises, bringing a lively multifaceted approach to problem solving. Starting dates are flexible.

Further information can be found at <www.nri.org/Training> or contact:

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Natural Resources Institute
University of Greenwich
Central Avenue, Chatham Maritime
Kent ME4 4TB, United Kingdom.
Fax: +44 1634 883567 or 880066.
Email: <j.r.brice@gre.ac.uk>.

A new course on **Food safety** is also being offered by the Natural Resources Institute, starting in September 2001. At the moment this is available only by attendance. The course will run over 45 weeks. For more details please contact the address above.

POSTHARVEST PUBLICATIONS

Mycotoxins and phycotoxins congress

The proceedings of the 10th International IUPAC Congress in Brazil on Mycotoxins and Phycotoxins, cosponsored by AOAC International, have been printed and some copies are available for purchase. The proceedings will be mailed to the contributors and to those who have already ordered and paid for the book. Copies can be purchased by paying US$70.00 for each copy (plus bank charges) into account number 057.45.32.668 in the name of Ir. W.J. de Koe at the ABN–AMRO Bank in Wageningen, The Netherlands. The address of the ABN–AMRO Bank in Wageningen is: Stadsbrink 43, 6707 AA Wageningen, The Netherlands. The SWIFT CODE of the Bank is: ABNANL2.

Alternatively, send a cheque for US$75.00 to Ir. W.J. de Koe , PO Box 56, 6720 AB Bennekom, The Netherlands.

In all cases please indicate clearly your name, address, and affiliation.

Postharvest handling of fresh vegetables

ACIAR has just published "Postharvest handling of fresh vegetables"*, the proceedings of a workshop held in Beijing, People's Republic of China, in May this year. The volume contains over 20 papers (titles given to right), covering a wide range of aspects of handling fresh vegetables in both China and Australia. Visit the ACIAR web site at <www.aciar.gov.au> for ordering details.

* O'Hare, T., Bagshaw, J., Wu Li, and Johnson, G.I., ed. 2001. Postharvest handling of fresh vegetables. Proceedings of a workshop held in Beijing, People's Republic of China, 9–11 May 2001. ACIAR Proceedings No. 105, 126p.

- Problems and countermeasures in postharvest handling of fruits and vegetables in China
- Postharvest handling systems assessment for vegetables in China and Australia
- Assessment of postharvest handling systems for vegetables in Beijing
- Postharvest handling systems assessment of pak choi and Chinese cabbage in eastern-central China
- Assessment of the postharvest handling system for broccoli grown in the Lockyer Valley, Queensland, Australia
- Increasing participation of end users in postproduction research and development
- The postharvest handling system for melon in northwestern China — status, problems, and prospects
- Postharvest handling of melons in Australia and China
- West Timor mandarin marketing case study — implications for supply-chain management in developing countries
- Industry trends in vegetable production and marketing in Beijing
- Trends in China's vegetable exports
- Australian studies on storage and packaging of Asian leafy vegetables, Chinese waterchestnut, and kabocha pumpkin
- Australian postharvest technologies for fresh fruits and vegetables
- Developing a quality assurance system for fresh produce in Thailand
- Preharvest effects on postharvest quality of pak choi
- Chinese cabbage management before and after harvest
- Sanitary washing of vegetables
- Storage of oriental bunching onions
- Storage of Chinese cabbage
- Fresh-cut Asian vegetables — pak choi as a model leafy vegetable
- Forced-air pre-cooling of vegetables
- Effect of hot water treatment on postharvest shelf life and quality of broccoli
- Effect of salicylic acid on shelf life of broccoli
- Using benzothiadiazole and biocontrol microorganisms for protection of melon from diseases. ■

CURRENT AWARENESS

NEWS

More support needed for postharvest, says World Bank VP

The Crawford Fund held another of its very successful annual conferences in Canberra during June. The topic this year was "Prosper or perish. Asian poverty and the Australian economy".

The keynote speaker at the conference was Mr Ian Johnson, Vice President and Head of the Environmentally and Socially Sustainable Development Network, World Bank, and Chairman of the Consultative Group on International Agricultural Research.

Mr Johnson discussed the challenges of achieving sustainable development, and how agricultural science can be mobilised as a key element for promoting economic growth, poverty reduction, and environmental conservation. He emphasised that developing an efficient agricultural sector is vital to achieve the goal of balanced development. Next year's World Summit on Sustainable Development, the "Johannesburg Earth Summit", will debate issues of poverty, environment, and sustainability. It was Mr Johnson's hope that meetings such as the Crawford Fund's 2001 conference would help define the agenda of the Summit.

In the QA session after his presentation, the first question asked of Mr Johnson was what he felt about support for postharvest activities. He responded that he thought that this was an area that needed more support.

This is good news for all of us who work in postproduction development assistance. The challenge is to convert these "thoughts" into action by international agencies.

New Executive Director for BPRE, Philippines

Engineer Ricardo L. Cachuela has been appointed Executive Director of the Philippines' Bureau of Postharvest Research and Extension, following the retirement of Dr Silvestre C. Andales in January this year.

The ACIAR Postharvest Technology Program has enjoyed many collaborations with BPRE and its predecessor NAPHIRE, and hopes to continue to do so in the future. We wish Mr Cachuela well in his new position.

PH News index

The contents of issues 47 (March 1997) to 57 (June 2001) of the Postharvest Newsletter have been indexed. A copy of the index can be found at <www.aciar.gov.au/postharvest/index.htm>.

ACIAR Postharvest Newsletter

This newsletter is published quarterly in March, June, September, and December by the ACIAR Postharvest Technology Program.

The Australian Centre for International Agricultural Research was established in June 1982 by an Act of the Australian Parliament. The Centre encourages research aimed at identifying agricultural problems in developing countries and finding solutions to such problems. It is empowered both to commission research and to communicate the results of such research to interested persons and institutions.

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ASEAN/APEC Postharvest Seminar

The 20th ASEAN/2nd APEC Postharvest Technology Seminar is being held in Chiang Mai, Thailand on 11–14 September 2001. For information about the seminar, go to <www.kmutt.ac.th/postharvest/postSem.htm>.

A report on the seminar will appear in the next newsletter.

Indonesia country manager appointed

ACIAR has announced the appointment of Ms Rhonda McLelland as ACIAR Manager for Indonesia. She took up the position on 1 August 2001.

Assistant manager appointed in Bangkok

Ms Thanawalai Jaroenjandang has been appointed as ACIAR's Assistant Manager in the Bangkok office. She will commence duties on 3 September.

FAO Global Initiative on Postharvest Technology — "From quantity to quality"

FAO has commissioned the the Global Forum for Agricultural Research (GFAR) to develop background papers and organise five regional stakeholder workshops to assess the status of the postharvest sector and its needs. At the recent P*h*Action meeting in Montpellier (see page 2), participants were updated on progress by Francois Mazaud (FAO), Rupert Best (CIAT), and Christian Hoste (GFAR). Five regional, technical consultations are planned — in East Asia/Pacific, Sub-Saharan Africa, West Asia/North Africa, Latin America/Caribbean, and Central Asia/Caucasus — but by an expert consultation in Rome. P*h*Action members were urged to participate in the regional conferences.

The East Asia/Pacific regional technical consultation will be held on 5–6 December 2001 at the South-East Asia Center for Graduate Study in Agriculture (SEARCA), Los Baños, the Philippines, with Dr Nerlita Manalili as the local coordinator. Dr Manilili can be contacted at <nmm@agri.searca.org>.

More "Current Awareness" on page 11.

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