



PARTNER COUNTRY: Pakistan

PROJECTS: Development of integrated crop management practices to increase sustainable yield and quality of mangoes in Pakistan and Australia (HORT/2005/153); Optimising mango supply chains for more profitable horticultural agrienterprises in Pakistan and Australia (HORT/2005/157)

DESCRIPTION: Australian researchers are working with Pakistani growers to find a solution to mango diseases, while improving supply-chain management

CONTACT: Associate Professor Ray Collins, ray.collins@uq.edu.au; Chrys Akem, chrys.ake@dpi.qld.gov.au

Research boost for ailing mangoes

Two research projects have begun that will give a boost to Pakistan's potentially lucrative mango industry

BY ROBIN TAYLOR

The sight of large mango trees dying for no apparent reason is an image that Australian mango grower and exporter John Morton recalls vividly from his visit to Pakistan as part of an Australian study group. The problem is known as mango sudden death syndrome (MSDS). Its causes are unknown, yet it reduces productivity in some orchards by more than 20%, and is affecting about 60% of trees in Sindh province, one of the two major Pakistani production areas.

Mr Morton, from north Queensland, says that being a mango grower in Pakistan is a difficult job: "Although Pakistan is one of the largest producers of mangoes

in the world, its industry is sadly lacking in regards to marketing, promotion and R&D."

However, Australian researchers and Pakistani growers hope that a solution to MSDS, along with improvements in nursery, tree and crop management, and improvements in supply-chain management, will be the outcomes of two new ACIAR-funded projects.

The first project follows an Australian study group investigation into mango production systems, with an emphasis on disease and pest management. At a workshop in the city of Multan, mango growers, researchers and government officials identified a number of R&D priorities for the industry—a major priority was to determine the causes of MSDS and to develop suitable strategies to control the syndrome.

For the ACIAR team, key issues of concern are early identification and procedures to stop or slow the progress of the disease. Other major issues identified during the visit were problems of orchard management related to nutrition, irrigation and water quality.

With an annual crop of about one million tonnes, Pakistan is the world's fifth-largest mango producer. It exports about 80,000 tonnes (more than the entire Australian crop), mainly to expatriate Pakistanis in the Middle East and the UK. While export volumes have grown over the past five years, the returns per kilogram have not, giving Pakistan the lowest return per kg (about 25 cents) of any major mango exporter in the world. The local market is limited because many people live below the poverty line and cannot afford to buy mangoes. In fact, there are concerns that current returns to growers are not viable. Compounding the situation, poor management practices further reduce growers' returns.

The leader of the new ACIAR project and member of the 2006 study group, Dr Chrys Akem from the Queensland Department of Primary Industries and Fisheries (QDPI&F), says there is an urgent need to train researchers and extension officers in basic diagnosis of plant diseases.

Nursery production of planting material has also been identified as an area that needs urgent improvement to stop or slow down the recycling of disease and pest problems in old and new orchards.

"Orchard management in most of the orchards we visited could be easily improved," Dr Akem says. "In most cases, nutrition appeared to be the main cause of poorly performing trees. In many cases growers were not sure of the nutrients to apply, what combinations to use or when to apply them."

After completing isolations from infected stem samples in Pakistan, the team brought culture isolates back to Australia under strict Australian Quarantine and Inspection Service (AQIS) guidelines, and identified a fungus suspected to be involved in causing MSDS. The cultures will be tested on mangoes in Pakistan to confirm if the fungus is actually involved or causing the disease.

The team visited Pakistan in February 2007 to initiate the new project. They are looking at short- and long-term solutions to the problem of MSDS.

"In the short term, we need some early-detection techniques," Dr Akem says. "The earlier you detect MSDS, the easier it is to follow up with management practices. In the longer term, we want to look at nurseries and establishing a certified nursery program because the problem is just being recycled."

He says nurseries are planted inside infected plantations, "so the young trees coming out of these plantations are already infected.

"We want to establish some kind of 'model' clean nursery, and then encourage some commercial partners to become involved to develop a long-term solution to the problem."

An even longer-term solution will require introducing resistant rootstocks to the dieback. The disease has been present in Brazil for several years and researchers there have identified resistant rootstocks.

"We have some of that germplasm in our collection here in Australia, so we are going to take some to Pakistan where it can be used to establish new nurseries from resistant rootstocks," explains Dr Akem.

While Dr Akem and his team investigated disease and other on-farm issues, another Australian study group focused on supply-chain issues.

Professor Ray Collins of the University of Queensland (UQ), a member of the second study group and leader of another new ACIAR project focusing on these supply-chain issues, says that improving product quality and reducing losses related to quality are the highest priorities for the industry.

Mangoes are grown in the provinces of Punjab and Sindh. Harvest begins in Sindh in late May and finishes in the Punjab in late August, which is the opposite of the season in Australia. Unlike in Australia, where the industry comprises specialist growers, mangoes in Pakistan are usually grown on mixed farms. Plantations range from small 2-hectare holdings up to 400 ha. Most farmers sell their crop at flowering to contractors who manage the crop—from irrigation and pest control, to harvesting, packaging and delivery to commission agents who sell it in the wholesale markets of Lahore, Islamabad, Multan and Karachi.

"Fruit-quality improvement must be the starting point before other issues, such as information management and the role of commission agents and contractors, are tackled," says Professor Collins. "Fruit quality is generally poor, and 30–40% of fruit is wasted in the harvest-to-market system."



Early mango sudden death syndrome (MSDS).
PHOTO: ROBIN TAYLOR

Sharing mango knowledge

SOSHEEL GODFREY AND MUHAMMAD IQBAL* VISITED AUSTRALIA IN NOVEMBER 2006 AS PART OF A PAKISTANI DELEGATION LOOKING AT AUSTRALIA'S MANGO INDUSTRY

The Australia Pakistan Agriculture Sector Linkages program (ASLP) seeks to transfer Australian knowledge and expertise to Pakistan's mango, citrus and dairy sectors. The ASLP has been established to lift the capacity of research, development and extension in Pakistan, and help alleviate poverty.

The tour was funded by ACIAR, utilising AusAID funds through the ASLP, and facilitated by two Queensland Department of Primary Industries and Fisheries (QDPI&F) officers, Rowland Holmes and Chrys Akem, who are based in Ayr.

The 11 Pakistani visitors, who included mango growers, exporters, researchers and horticulture development officers, were briefed on Queensland's mango industry and taken to several modern orchard operations around Ayr.

Our first stop was Queensland Emu Exports, a mango orchard and packing shed belonging to John Morton, who had visited Pakistan earlier as part of an Australian team. The following day we saw mechanised harvesting in operation and visited a gene

collection comprising 300 mango varieties from around the world.

At Mareeba, comprehensive presentations were given by scientists at the QDPI&F Mareeba Research Station, and we visited Lagoma Orchards where a computerised micro-irrigation system makes it possible for just two people to manage a 100-ha farm. At Diamond Star, a farm and packing shed with a high-tech vapour heat treatment (VHT) facility, a harvest of mangoes was being packed for export to Japan under Japanese supervision.

We found the Australian farmers' direct involvement in orchard management and postharvest operations, which is not common in Pakistan, to be of great interest.

At the DPI&F in Indooroopilly, general manager John Chapman highlighted the importance of mangoes for Australia and Pakistan. We were given presentations on building and managing supply-chain relationships; achieving commercial success through the supply-chain approach; disinfestation and area-wide management; and postharvest disease identification and control.

At Maroochy Research Station we had a technical presentation on postharvest handling and a briefing on the activities planned under ASLP.

The delegation concluded that the Australian mango industry has large, economical farm sizes that enable it to absorb technology, and this facilitates access to production and postharvest management technologies. The farmers control quality through



Tree with advanced mango sudden death syndrome (MSDS).

PHOTO: ROBIN TAYLOR

For example, at harvest, fruit is often dropped from the tree by either cutting or hitting with a pole, causing severe bruising. Trees are harvested once only each crop, meaning that some fruit will be immature.

“Wide variations among prices at farm, wholesale market and retail levels highlight a system where there are few rewards for quality,” Professor Collins says. “And returns are distributed quite unevenly, favouring middlemen.”

At the retail level, most mangoes are sold by street hawkers, who purchase their daily requirements from

the local wholesale market and have little storage space and no cool rooms. They sell fruit and vegetables from mobile carts or street stands shaded by umbrellas or tarpaulins. At the start of the day the price of mangoes starts high, at about 30 rupee per kilogram, and by the end of the day they may sell for as little as 5 rp/kg (about 10c/kg).

Professor Collins says that a couple of major retail chains are planning to enter the Pakistan market within the next two years. To sell to these outlets the industry would need to meet strict quality specifications. Other multinational companies are also looking to source mangoes from Pakistan to supply supermarkets overseas, which would also require the industry to meet quality, food safety and traceability standards.

The researchers identified major problems at all stages of the supply chain. Poor production systems were combined with inadequate handling, storage and transport.

“The industry faces some major challenges, particularly in postharvest handling systems,” Professor Collins says. “There is very little cool storage, and with temperatures often around 50° C during harvest, fruit has a very short shelf life.”

Grading and packing is usually carried out in the field, or sometimes in open sheds with earthen floors. Wooden crates are packed until they bulge and the lid is nailed on. Damage occurs from bruising and punctures

well-managed operations starting from growing, harvesting, grading and packing through to storage and ripening. Australia has a well-developed services sector complemented by effective research, extension and industry linkages.

The Australian experience can be replicated in Pakistan in phases if modified to our agro-ecological and socioeconomic conditions. In the short term we should concentrate on selected groups of farmers, traders and service providers who have the means to improve.

We need technical support from Australian institutions like the QDPI&F and the University of Queensland in collaboration with Pakistan's Horticulture Development and Export Board (PHDEB) and universities, as well as provincial agricultural research and extension departments.

In the medium to long term we need to form associations of farmers and traders to take the lead in industry development. Improved production and postharvest management technologies in the whole of the value/supply chain is necessary, as is human resource development through training and degree courses.

* *Sosheel Godfrey is the program leader for the Australia Pakistan Agriculture Sector Linkages Program (ASLP); Muhammad Iqbal is chief operating officer of the Pakistan Horticulture Development & Export Board (PHDEB).*



Muhammad Iqbal (standing, fifth from right) and the ASLP Pakistani mango delegation at Johnson Mangoes in Ayr, Queensland.

PHOTO: SOSHEEL GODFREY

by nails in the crates. Commission agents also request overloading of trucks, so they can minimise the cost of transport and market levies, which are charged on a per truck basis.

Growers need better access to information, specific skills training and more incentive to take responsibility for the quality of mangoes they produce.

Commission agents hold most of the power in the supply chain and improvements depend on their support and involvement.

The researchers also looked at transport issues. Air space out of Pakistan is limited during the mango season as all airfreight goes on passenger planes. The exporters only get short notice of air space availability, so they are forced to source from the nearby major markets. Many exporters complained about the limited cool storage at Karachi airport and loads are often left sitting on the tarmac, where temperatures can exceed 40° C.

In terms of sea freight, many of the small vessels sending fruit to the Middle East are slow, inefficient and barely seaworthy but continue to be used due to cost. Open containers offer no protection or temperature control. Some of the issues associated with exported fruit that the researchers identified were: carton collapse, short shelf life and breakdown from disease, dehydration and shrivelling, damaged fruit and over-ripe fruit.

On the export market mangoes from Pakistan have a

reputation for being cheap and of low keeping-quality, albeit with good flavour.

Exporters are eager to learn how to extend mango shelf life and how to access new markets; and there is a clear need for technical information to improve exporters' practices.

With this in mind, Professor Collins says the new project aims to identify present market needs and likely future opportunities for mangoes from Pakistan, analyse existing supply chains and develop improved supply-chain management systems and practices.

The two new projects, which have been developed following scoping studies, will be carried out by teams from UQ, QDPI&F, Department of Agriculture and Food, Western Australia, the Pakistan Horticulture Development and Export Board, the University of Agriculture, Pakistan, and the Pakistan Agricultural Research Council.

The first project will focus on improving crop management practices to increase yield and quality, as well as developing improved tree husbandry and management options, improving detection and management of MSDS and other diseases, and building the capacity of the mango industry to undertake integrated crop management. The second project will focus on optimising supply chains by looking at mango quality improvement and maintenance, market research and developing demonstration supply chains. ■