**ECONOMIC EVALUATION UNIT**

**WORKING PAPER SERIES**

**NO. 27 AUGUST 1997**

# EVALUATION OF THE CRAWFORD FUND MASTER CLASSES IN BIOTECHNOLOGY: and a tracer study of participants, their sponsoring institutions and course providers

J.R. McWilliam, R. Sdoodee and L. Marlow

Australian Centre for International Agricultural Research

ISBN 1 86320 231 7

## ACKNOWLEDGMENT

This independent evaluation of the master classes in biotechnology, a program under the Crawford Fund for International Research, was initiated and supported by the Australian Centre for International Agricultural Research (ACIAR). The Centre funded the initial classes and since then has continued to provide the major support for the program. The evaluation committee would like to thank ACIAR for the Centre's helpful support and assistance throughout the review and also other stakeholders who were a valuable source of information on all aspects of the current operation and future plans for the program.


## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ACIAR | Australian Centre for International Agricultural Research |
| AusAID | Australian Agency for International Development |
| AVRDC | Asian Vegetable Research and Development Center |
| CABI | Commonwealth Agricultural Bureau International. |
| CD | Compact Disk |
| DEST | Department of the Environment, Sport and Territories |
| DIST | Department of Industry, Science and Tourism |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DC | Developing Country |
| DNA | Deoxyribonucleic acid |
| IDP | International Development Program |
| IRRI | International Rice Research Institute |
| ISNAR | International Service for National Agricultural Research |
| R&D | Research and Development |
| SADC | Southern African Development Council |
| UNIDO | United Nations Industrial Development Organisation |
| UPM | Universiti Pertanian Malaysia |

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# EXECUTIVE SUMMARY

## Assessment of Master Class Program

The master classes in biotechnology represent a new development in the retraining of professional scientists in developing countries The specific purpose of this training has been to expose mid-career scientists and scientific administrators involved in agricultural research to the principles of molecular biology underlying the new techniques and tools of biotechnology, and the application of these to improve the efficiency and outcomes of the research activities in their own institutions.

The catchment for candidates for the master classes in biotechnology has been East and South Asia, which corresponds to the major focus for Australia's aid funds. Within this region, participants have been drawn from 14 countries, with over 70% coming from six of these, Thailand, Australia, Indonesia, Malaysia, Philippines and Vietnam. Of the 11 master classes held to cater for these candidates, 7 have been held in Australia, 2 in International Agricultural Research Centres in Asia and two in more advanced Asian countries, Thailand and Malaysia.

This independent evaluation of the master class program was initiated by ACIAR, who has been the major supporter of the program since its inception, The objectives of the evaluation were to assess the extent to which the program has achieved its objectives, the quality, rigour and relevance of the courses and the benefits and impact of the new technologies on the research programs of the participants and their institutions The evaluation also considered future strategic issues that are likely to influence the operation of the program, including the design scope and possible expansion of the program and its funding sources.

Because of the difficulty of interaction with all those involved in the master classes, the evaluation committee developed three detailed questionnaires which were distributed to all those who had been involved in presenting the classes to the participants, and to the agricultural research organisations supporting their attendance. Interviews were also held with a wide cross section of those involved with the master classes in Australia including other stakeholders who were interested in the program and the special training approach

These surveys demonstrate the master classes had an excellent reputation and were judged to be of a high standard, effective in achieving their objectives and relevant to the client's research and teaching needs A total of 90% of the participants, together with those providing the courses material, felt that the length and content of the material presented was about right, but at the same time, about half of the participants expressed a preference for more 'hands on' practical exercises. There was general agreement that it was not necessary to have had previous training and experience in molecular biology, but that a science background and some awareness of the field of biotechnology through previous teaching or research was sufficient to understand the material and benefit from the training.

The major benefits of the master classes as indicated by the participants, were that they opened up new areas for research and teaching in their organisations and opportunities for collaboration with their own colleagues and others in the region and in Australia. They also indicated that this background gave the staff greater access to research grants and further training opportunities.

The research institutions and universities whose staff attended master classes reported that the experience significantly improved their staff's research and teaching skills and that on return, they showed greater confidence in applying the new technologies in their research These same institutions also indicated that they would be very willing to nominate additional members of their staff to attend further master classes in biotechnology.

One of the clear messages that emerged from the survey was the request for an increase in the number of master classes and a widening of the scope, especially in regard to the courses dealing with the application of biotechnology in more specific areas of research. Those participants who were not actively involved in research, found the more specialist courses difficult, and would have preferred a more general approach to the research applications. Part of this problem lies in the selection of candidates resulting in a mismatch between the course content and the skill levels of the participants The improved procedures for selecting candidates and the development of courses better suited to the needs of each group could help to solve this problem.

Despite the popularity and success of the master classes, the lack of a formal follow-up program to consolidate the training and help in the implementation of the new technologies, is seen by the majority of participants and the class providers as a problem. This is particularly true for the more specialised master classes that focus on the application of the basic principles and the derived technology in particular areas of research. Efforts to overcome these problems and to achieve better adoption and implementation of the technology in the research programs of the various research institutes and universities, will be important to achieve the longer term impact of the program.

**Future Strategic Issues**

A number of strategic issues will need to be addressed by the master class program in biotechnology in the next few years, to sustain the momentum of the program and to respond to the demands of those wishing to attend classes and other donors and training organisations who see the approach as relevant to their own needs.

The demand for an expansion in the number and scope of master classes by the clients provides an opportunity to develop a set of courses designed to meet the more specific requirements of three client categories, the mid-career scientists and the senior managers in agricultural research, (which are currently grouped together) and the top level agricultural leaders and decision makers, responsible for policy issues and the funding of agricultural research. Catering for these different groups would increase the total number of master classes, and would respond to the demand for more specialist courses for the practicing scientists, It would also permit the content and duration of the classes to be tailored to meet the specific needs and time constraints of those managing and funding agricultural research, but who are no longer practicing scientists.

Any expansion of the master class program in biotechnology will have to be conditional on the availability of the necessary human and financial resources. The current core budget provided through the Crawford Fund will not be sufficient to cover any significant expansion. The program will have to become more market orientated and explore opportunities to raise additional funds from national and international aid organisations and others interested in

accessing this form of training. In the past the program has been successful in using relatively small inputs from its own budget to catalyse additional funds from other donors wishing to support the master classes for their own training purposes. This approach is to be commended as it helps to 'spill-over' the benefits to a wider range of clients in the region.

The major catchment in the developing world for participants in the master class program should remain in East and South Asia, but the choice of countries in these regions should be flexible, with decreasing emphasis over time, on those countries with the most advanced economies and strongest programs in biotechnology. At the same time, a continuation of the trend to hold more of the master classes at locations in developing countries should be encouraged. Those courses requiring more sophisticated equipment and facilities have to be more selective in choosing locations, but the classes for senior administrators and decision makers, are less demanding and there are advantages in holding these in developing countries, as they provide situations and conditions similar to those in which the participants are working.

The master classes are one of the components of the Crawford Fund training program and are managed by a Coordinator who is responsible for all aspects of the planning, organisation and conduct of the courses. If the program is to expand and increase the number and scope of its classes, the review committee believes that it would benefit from having a small representative subcommittee to advise the Coordinator on all aspects of future planning, funding and other strategic issues concerning the operation of the program. In addition, further secretarial support will also be needed to augment that current part time administrative support provided by the Crawford Fund.

An important feature of the master class program has been the generous support provided by a number of organisations and in particular, the *in kind* support received from the research institutions and universities both in Australia and in developing countries. This has been mainly in the provision of senior staff for teaching and support staff and facilities for the operation of the classes. This support has enabled the program's own core funding to achieve considerably more than would normally have been possible

The other major supporter of the master class program since its inception has been ACIAR. The Centre has utilised the master classes to upgrade the skills of ACIAR's research partners in modern biotechnology which is a component of many of the collaborative research projects The evaluation committee sees mutual benefit in ACIAR's continued support of the program and its use as a *de facto* training component of the Centre's own biotechnology research program.

**Summary**

Overall, the master class program in biotechnology has been successful in achieving its major objective of helping mid-career professionals in developing countries gain access to the modern approaches in biotechnology to help improve the quality and productivity of agricultural research. The response of the clients in the region to the program has been very positive and there is a demand for more frequent classes covering a wider range of applications of biotechnology in agricultural research

The programs strength lies in its innovative approach to training, the importance of the target group and the high quality of those providing the class material There is also a strong sense of partnership as measured by the willingness of both providers and participants to contribute to the cost of running the program. Although the entire master class program is relatively small, its potential catalytic effect through targeting key mid-career professionals in the developing countries is quite considerable.

The next challenge will be to maintain this early momentum and expand the program and its resources to meet the demand, while maintaining the quality, relevance and ownership of the program The most urgent task will be to strengthen the follow-up activities so as to ensure that the information and skills developed as a result of the training, are implemented in the research and teaching activities of the clients institutions, and ultimately expressed in improved outcomes from their research.

# 1 BACKGROUND

## 1.1 History of Master Classes in Biotechnology

Master classes in biotechnology[1] were initiated in late 1992 as a component of an ACIAR funded project, involving a research network to investigate new approaches for the control of bacterial wilt in tomatoes and other vegetable crops. The initial classes were designed to provide the members of the network with exposure to the basics of molecular genetics and to use the new technologies to improve the quality and outcomes of their research program.

By 1994, in response to the demand for this type of training and with support of the Crawford Fund for International Agricultural Research and other donors, the master classes took on a life of their own and became one of the training programs managed by the Fund. At the same time the scope of the classes was expanded to cover the core technologies emerging from recent research in molecular biology and the application of these to a wider range of research disciplines in agriculture (agriculture, forestry and fisheries)

The master class program is different from the usual short term training programs, which are mostly designed to improve specific skills of younger graduates and technical staff from developing countries. As developed, the new program is designed to serve a different set of clients, the mid-career scientists and senior scientific managers working in the field of agricultural research in developing countries.

The purpose of the training has been to provide these mid career professionals with a better understanding and appreciation of recent developments in biotechnology, so they can encourage and support the use of these new technologies in their own institutions. Their application in disciplines such as microbiology, genetics, pathology and animal reproduction, can have an important impact on the quality and effectiveness of the research and in the longer term, it has the potential to achieve major improvements in agricultural production

The classes are designed to develop a sense of partnership between course providers and the participants, which facilitates the exchange of information and advice and helps to maintain contact following the training period. For these reasons, the class numbers have been kept small, usually about 15 participants. The course of lectures, laboratory and discussion sessions usually runs over a period of about three weeks, depending on the nature of the course, The master class coordinator and those providing the instruction and teaching support are drawn from research institutions and universities in Australia. When classes are held outside Australia, staff from the host institution act as resource persons for the classes and make available the necessary equipment and facilities.

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**[1] The term biotechnology in this report refers to a range of new developments and techniques in molecular biology involving recombinant DNA technologies, gene cloning, molecular markers, (gene tagging), the development of transgenetics and other new diagnostic tools that have broad application in the disciplines of modern agricultural research.**

The geographic focus for the master classes in this initial period has been with developing countries in East and South Asia. To date a total of 11 master classes in biotechnology have been held, 7 in Australian institutions, 2 in International Agricultural Research Centres in Asia (IRRI and AVRDC), and two in more advanced countries (Thailand and Malaysia).A total of 176 mid-career, agricultural scientists and administrators have been trained over this five year period. This figure includes 11 Australians who are eligible for the classes on the same basis as those from the Asian region, These details are given in Table 1.

**Table 1 Location and title of master classes in biotechnology held over the period 1992-1997, (giving total class numbers and number of Australian participants.)**

| Date | Title of Master Classes | Location | Total Number of Participants | Number Australian Participants |
|---|---|---|---|---|
| Nov/Dec 1992 | Microbial and Plant Molecular Genetics | Monash, Vic. Australia | 14 | 0 |
| Nov/Dec 1993 | Microbial and Plant Molecular Genetics | Monash, Vic. Australia | 18 | 1 |
| Nov/Dec 1994 | Microbial and Plant Molecular Genetics | Monash, Vic. Australia | 18 | 1 |
| Feb 1995 | Dairy Technology | La Trobe, Vic. Australia | 15 | 1 |
| June 1995 | Beef Cattle Reproductive Technology | Tropical Beef Centre, Rockhampton, Qld. Australia | 15 | 0 |
| Nov/Dec 1995 | Use of DNA Technologies in Biodiversity, Plant Breeding and Biosafety | Bangkok, Thailand | 25 | 1 |
| Nov/Dec 1995 | Plant Molecular Biology | CSIRO, Canberra, Australia | 18 | 4 |
| May 1996 | Microbial and Genetics and vegetable diseases | AVRDC, Taiwan | 12 | 0 |
| Nov/Dec 1996 | Microbial and Plant Molecular Genetics | Monash, Australia | 12 | 3 |
| April/May 1997 | New Technologies for Measuring Biodiversity | UPM, Kuala Lumpur, Malaysia | 15 | 0 |
| June 1997 | New Technologies for the Diagnosis of Tropical Plant Disease | IRRI, Philippines | 14 | **0** |
| **TOTAL NUMBER** | 11 | | 176 | 11 |

Over this period the demand for places in the master classes has been increasing, especially for those classes dealing with the application of new technologies from biotechnology to a particular disciplinary area, or research fields, such as the diagnosis of plant diseases, This interest in obtaining guidance in the application of new technology can be seen in the requests for this type of master class in the questionnaires (Annex 1)

In addition to the interest by potential participants, there have been approaches by research institutions in the Asia region and by the international aid agencies to become involved in the master classes, either in partnership with the master class program, or through contracting the program's services to provide master classes to complement their own programs.

## 1.2 Administration and Funding

The master classes in biotechnology, which represent one of the training programs in the Crawford Fund, are managed by a Coordinator, who, in consultation with the clients in the developing countries and the stakeholders and course providers, is responsible for the selection of the topics and the locations for the various classes. The coordinator is also responsible for advertising the courses in the catchment region, and selecting participants for the classes. Some financial and administrative support is provided by a staff member in the Crawford Fund for this purpose.

Responsibility for managing a master class, can be delegated by the Coordinator to the senior specialist involved, especially if the class is held in this persons research laboratory using local staff and facilities. With this support, the program has been able to offer three courses per year and is planning to continue this policy for the next two years. One of the valuable inputs to the master classes, which has enabled the program to maintain its high quality and cost effectiveness, has been the generous *in-kind* support provided by the universities and research organisations associated with the program, both in Australia and in the Asian region,

The support for the master class program is derived from Australia's overseas aid funds distributed to Crawford Fund via ACIAR. It provides the program with a notional budget of $100000 per year, In recent years the annual expenditure of these funds has been well below this figure due to the support received, especially from ACIAR and other donors, who fund participants to attend classes and contribute to the cost of running the classes, especially when held in their institution or when the topic is of special interest.

The total costs of running a master class appears to be in the range of $50000 to $60000, however, because of the generosity of research organisations and universities, the actual cost of hosting a master class, either in Australia or in Asia, has been much less. For example, the average cost to the Crawford Fund of the four master courses run in 1996 averaged around $30000 each. Some idea of the direct contribution to the cost of running master classes over the last two years is given in Annex 2. This does not include the *in kind* costs which have been quite considerable and in most cases far greater than the direct contributions.

This additional support for the master class program is a measure of the standing of the Crawford Fund and the quality and relevance of the master class program. In the future, however, there is no guarantee that this support will continue at the present level, and the program needs to be thinking about alternative sources of funding.

One such initiative could be to call on those institutes and participants who benefit from the classes to begin contributing to the cost of attending. This requirement could be waived in some of the less developed countries, but for those who can afford to contribute, it could send an important message that the program does not have unlimited funds, but is of high quality and entry to the courses is competitive.

# 2. RATIONALE AND METHODOLOGY FOR EVALUATION

## 2.1 Rationale

During its first five years the master classes, with the support of the Crawford Fund and others, have pioneered a new type of research training in agriculture that has not been available in the Asian region. It is filling a niche that has proved to be popular with the mid-career scientists and administrators, For those who have participated in the program, it has been an important influence on their attitude to modern biotechnology and the way in which it can expand opportunities in agricultural research and improve the quality and effectiveness of the outcome

The decision by ACIAR to evaluate the master class program at this stage of its evolution is timely and in line with the policy of the Centre and its accountability for the expenditure of overseas aid funds. In addition, ACIAR has been responsible for funding the program in its initial years and this has continued to a large extent since it has become a component of the Crawford Fund. The timing is also appropriate, as the program has reached a stage in its development when important decisions will have to be made about its future directions.

The evaluation of the program is designed to advise ACIAR on the extent to which it is achieving its objectives, the quality, rigour and relevance of the courses and the impact of the training and possible benefits accruing to the participants. There is also a need to consider future options for expanding the design and scope of the master classes in biotechnology to meet the evolving needs of the potential participants and to assess these in relation to the current funding and administrative arrangements. The detailed terms of reference are set out in Annex 3.

## 2.2 Methodology

A committee was established to undertake the evaluation. It consisted of three members, the Chairman, represented by a person with an agricultural background and experience in research, teaching and international aid, an overseas member, a former participant of a master course and a research specialist from Prince of Songkla University in Thailand representing the clients, and the third member, the Managing Director of a consulting firm with responsibilities for the questionnaires and their interpretation. Two resource persons from ACIAR provided administrative support. The committee had the responsibility for planning and overseeing the evaluation, including the design and processing of the questionnaires, and the final approval of the report and its transmission to the Director of ACIAR. The committee met twice and held informal discussions following the circulation of the draft report.(Details of the membership of the committee are given in Annex 4).

It is difficult to evaluate the master class program in which classes are held periodically and in a program which involves providers, participants and stakeholders**,** all of whom are scattered across Australia and the Asian region, For this reason it was decided to use questionnaires to obtain information from those directly involved in the program, including the presenters, participants and their home institutions. The detailed information obtained is presented in Annex 1 and summarised in Section 3 of this report.

Another group of stakeholders, who are directly and indirectly involved in the program including the Director of the Crawford Fund, were also interviewed, more in relation to strategic issues influencing the future of the program. Those interviewed are listed in Annex 5. The conclusions from these discussion comprises much of the material discussed in Section 5 of the report.

# 3. INFORMATION FROM SURVEYS

**Response to Survey Questionnaires**

Questionnaires were sent to each of three client groups directly involved in the master classes in biotechnology. These three were, the institutes providing staff (participants) for training, the scientists providing the courses and the participants who have attended the various master classes. The full details of the responses received from each group are provided in Annex 1. Only a summary of this data is presented in this section with a focus on the major issues raised in the terms of reference.

## 3.1 Institutions Providing Staff for Master Classes

The institutions providing staff for the master classes were predominantly from the developing countries in south east and south Asia, and were representative of the universities and research institutions in these regions.

*Responses from institutions that sponsored participants*

| Questions | Scale | Score or Responses |
|---|---|---|
| 1. Have staff improved their research or teaching skills through attendance at a master class (mc)? | Significantly = 10 Moderately = 5 Insignificant = 1 | 7.2 (mean score). |
| 2. Was the mc attended by your staff both useful and relevant to your institute's objectives? | yes or no | 93% claimed mc useful and relevant. |
| 3. Have the contacts made as a result of the mc's resulted in further interactions and/or collaborative activities? | yes or no | 60% responded yes and gave details of collaboration or collaborative research with other institutions. |
| 4. Do you favour some form of follow-up to the mc's for the benefits of the participants and the mc program ? | yes or no | 88% agreed that follow-up would be beneficial. Suggested refresher courses and research collaboration. |
| 5. Would you nominate your staff to attend mc's in biotechnology or in other topics in agriculture | yes or no | 92% would continue to nominate staff for both |

## 3.2 Master Class Providers

Those presenting the course material were from universities and the research organisation (Depts. of Agric. and CSIRO) in Australia. The support staff who assisted with the teaching and practical exercises were also drawn from Australia and when the classes were held overseas they were assessed by staff from the Institute hosting the master class.

*Responses from Master class providers*

| Question | Scale | Responses |
|---|---|---|
| 1. What is your view of the design of the mc's (length, structure, content balance)? | _____ | Great majority felt courses were either good or excellent. |
| 2. What is your view on the relevance of the course content to the needs of the participants? | _____ | Some criticism of mismatch between course content and level of skills and understanding of student. |
| 3. Indicate your views on selection of candidates; their prior experience, English comprehension, and their ability to apply new learning and skills on return to positions in their parent institutes? | _____ | Most agreed selection of candidates is satisfactory and improving. A few claimed that their training was not in the area in which they worked and it might be difficult to apply their new skills. |
| 4. How adequate was the background briefing given to the course providers on the participant's ability to apply, learning and skills on return to their institution? | _____ | Sufficient to very good. |
| 5. What are the relative values of a generic course based on core technologies in biotech compared with one on the application of these technologies to a specific area of agriculture? | _____ | When participants were from diverse backgrounds, core courses are possibly the best, but when participants are specially selected, mc's focused on specific areas for applications are very appropriate and popular. |
| 6. What are the pros and cons of holding mc's in Australia versus a developing country? | _____ | There are advantages in both. The equipment, expertise, facilities are best in Australia, but conditions in DC's, although not as good, may be more realistic. |
| 7. What has been the level of satisfaction with your mc teaching experiences? | (I) v. satisfied (ii) satisfied (iii) less than satisfied | 50% very satisfied. 50% satisfied |

### 3.3 Participants in Master Classes

A profile of the participants indicates that they are predominantly under 45 years, with the majority coming from south east and south Asian countries. The majority work for government institutions (universities and research institutions) and have postgraduate qualifications (Msc and PhD). They are drawn from a range of plant and animal disciplines, with the largest number coming from the disciplines of plant pathology and microbiology. Prior to attending the master class about two thirds had a good to fair understanding of molecular biology and the topic of the course, while one third had only a slight understanding and experience. Most applied to attend the master class to improve their knowledge and skills in research and teaching and to be able to use this to introduce these technologies into their research through collaboration with specialist researchers in the field of molecular biology (new biotechnology).

*Responses from participants*

| Question | Scale | Responses |
|---|---|---|
| 1. What is your assessment of the mc you attended? | 5 Excellent 3 Satisfactory 1 Less than satisfactory | Majority of responses (95 %) indicate that the mc's were between satisfactory and excellent. (Mean score 4) |
| 2. How important was it to have had previous teaching or research experience in the basic principles of the mc? | _____ | 99 % of participants indicated previous teaching or research experience was of some importance. |
| 3. Within the time available for the mc, how did you find the course content? | (i) too difficult (ii) about right (iii) other | 90 % considered the course about right, only 9% indicated that it was too difficult. |
| 4. What was your impression of the balance between lectures and practical exercise? | (i) about right (ii) need more lectures (iii) need more practicals (iv) other | 45 % claimed the balance was about right. 43 % wanted more practicals more 'hands on' activities. Amongst 'other' some wanted more lectures and practicals. |
| 5. What benefits did you obtain from undertaking the mc? | _____ | 46% claimed that it 'opened up new possibilities for my research'.33% 'now appreciate the role of biotechnology. in research, and opportunities for collaboration'. |
| 6. Have you experienced difficulties implementing knowledge and skills obtained from the mc you attended on return to your institution? | yes or no | 60% had some difficulties due to lack of specialised equipment and materials, also lack of a biotechnology group or staff with experience in the institute. These were the major reasons. (for comments see Annex 1) |
| 7. Do you think these difficulties might have been reduced through follow-up? | _____ | About half experienced some difficulties and of these 80 % felt that some form of follow up would have reduced the problems encountered. |
| 8. What forms of follow-up would have been most helpful after completing the mc? | _____ | (i) Electronic communication with mc staff. (ii) Visits by mc staff or other biotechnology, specialists. (iii) In-country meetings. (for other comments see Annex 1) |

# 4. ASSESSMENT OF THE MASTER CLASS PROGRAM IN BIOTECHNOLOGY—1992

The information in this section has been based largely on the detailed questionnaires reported in Annex 1 and Section 3.1, and the comments of other stakeholders who have been closely associated with the program over the last five years.

## 4.1 Quality and Relevance

All those who responded to the questionnaire, and especially the participants, considered the classes to be very effective and 95% of the respondents gave it a median score 4 out of 5, between satisfactory and excellent. Most participants felt that the classes were highly relevant to their research and teaching needs in their institutes. Those providing the classes (not surprisingly) felt that the length and content was about right, as did 90% of the participants (9% found the classes too difficult), however, nearly half of those that approved indicated a preference for a greater proportion of the course to be devoted to practical exercises.

Another measure of the value of the courses is the almost unanimous (95%) positive response by institutions supporting participants when asked if they would support further staff members for master classes if the opportunity arose. Also there was a desire by both institutes and their staff to have access to a greater range and frequency of master classes dealing with other research topics in agriculture in which the techniques of biotechnology are relevant.

Despite the overwhelming support for the master classes and the positive comments by all parties, there is evidence that the classes are too advanced for a few of the participants. The number is small and includes those with little or no relevant background in science. Over time, the selection of participants has become more effective in ensuring that those who are accepted for a particular class, do have some background and experience and the motivation to appreciate the training and benefit from the information.

## 4.2 Selection of Candidates

Following advertisement, the participants for each class are selected from the available applicants based on a number of criteria. These include proficiency in English; professional experience; current position and responsibilities; motivation for undertaking the class and opportunity to apply knowledge and skills gained through the class on return. There is also a requirement for evidence of support from the candidate’s own institution.

Prior training and experience in molecular biology (new biotechnology) is not required, or necessary for these master classes, however, 99% of candidates in the survey claimed that previous research or teaching experience in the scientific principles underlying the courses were of some importance,

This selection procedure continues to improve with experience and the use of more relevant questions in the application. The few examples of inappropriate candidates, occurred mostly in the early years of the program, either because of mismatch between course content and skill level of the participants, and/or because the course was too specific for their more general needs.

More than half the class providers agreed with the suggestion that debriefing after involvement in a class would be valuable, and may help to identify ways to further improve both the selection of participants and format and content of the classes..

Under the present arrangements the institutes who authorise the participation of their staff have little input into the choice of those accepted for training. In the responses to the survey, quite a number of these officials indicated that they would like to have more say in this selection where it concerns their own staff. This seems to be a reasonable request and should be considered.

### 4.3 Benefits

The major benefits of the master classes cited by the participants were their appreciation of the role of biotechnology in their research field and the acquisition of information and skills to improve the quality of their group's research and opportunities for greater collaboration., They also indicated that this background gave them greater access to research grants and further training opportunities. The more senior research managers acquired a better appreciation of biotechnology and what is needed in the way of facilities and equipment to integrate these new technologies into their institute's research programs.

Those institutes providing participants for the classes reported that the attendance at the master classes significantly improved the staff's research and teaching skills. They also believe that these staff members now show more confidence in applying the new technology in their research and also in seeking contacts and opportunities for collaboration with biotechnologists in and out of their respective countries. They described the classes as a useful first step in forming a scientific bridge between their own institutions and others in Australia and elsewhere.

The benefits for Australia from the master class activities tend to be more indirect, resulting from follow up activities in the form of research collaboration, often with those providing the instruction, or with other researchers in their institutions, The exposure of participants to the research capabilities in Australia has resulted in students and staff from institutions involved in the master classes undertaking postgraduate studies in Australian universities. Also those providing the instruction and their research groups in Australia claimed to have gained a greater understanding of the research problems and the availability of research material in the developing countries, which in some cases, is of direct relevance to on-going research in Australia.

Most of the participants from the master class program are mid-career scientists and senior managers from leading research and academic institutes in their own countries. Over time, as they become more senior and move to positions of greater influence in their own countries, the previous linkages and good will developed as a result of the master classes will be helpful to Australia in developing further scientific and commercial partnerships with these countries.

### 4.4 Follow-Up and Implementation

Follow-up with the participants to help to consolidate the information and skills acquired during the master classes and to exploit opportunities to implement the new technologies in some aspect of the institutes research, is essential if the master classes are to have a lasting impact. To

date the program has not been able to institute a formal-follow up program, largely because of the cost and the availability of trained research staff for this purpose. The participants, on return to their institutes, have relied on informal networks and on a continuation of the contacts made with other researchers involved in the courses, together with their course providers. Some (17 %) of the participants have subsequently been able to visit Australia for more direct advice and follow-up. Discussions on a one-to-one basis with the class providers during the course, on how to apply the technology in the specific research programs of the participants has also been useful and this approach should be strengthened wherever possible. A more formal approach to the problem of follow-up is also needed and some suggestions are discussed in Section 5.

Reporting the outcome of the individual master classes is another form of follow-up and has been done regularly. It provides a useful record of those providing the classes, the participants and the details of the course material. These class reports should also provide a more candid critique of the class, including comments from all those involved, which could help identify aspects that could be improved

### 4.5 Geographic Location of Master Classes

The majority of the master classes to date have been held in Australian research institutions, or universities, largely because of the need for specialised equipment and facilities. Many of the staff presenting the classes however, indicated that there were advantages in holding classes in the better equipped institutes in developing countries, as they would be conducted under conditions which were more realistic for those returning to apply modern biotechnology techniques in their own research institutes. When courses are held off-shore, it is important for the coordinator, or the person delegated to run the course, to visit the institution hosting the master class in advance, to ensure that all arrangements, equipment and other facilities are organised in time for the classes. In general, it appears that the location of the classes is determined largely by the nature of the class and the availability of the appropriate facilities and support staff, but off-shore locations have advantages where facilities are available and the frequency of these has been increasing.

### 4.6 The Scope of the Master Classes

Within the existing focus of the master classes in biotechnology, two types of courses have evolved. One, a course dealing with the basics of molecular biology and the associated techniques and its potential for agricultural research. This course is probably best suited for those involved in research management. The second course involves similar basic principles, but with a greater focus on the application of these to specialised research areas in agriculture. This distinction would appear to be quite valid, and is supported by the course providers, who believe that stressing this difference when advertising courses and making it more explicit in the application forms, would reduce the diversity of backgrounds among course participants.

Recently a third category, or type of master class, has been proposed to cater for more senior decision makers. The first course of this type, will be part of a series, is to be held in collaboration with ISNAR, in Jakarta. It will take place in November 1998 and will be shorter than the existing master courses and designed to provide key agricultural personnel with the opportunity to enhance their management and leadership skills, with special reference to

biotechnology. The adoption of this type of decision makers course within the master class program is discussed in Section 5. of this report.

### 4.7 Value and Impact of the Master Classes in Biotechnology.

The master classes have been successful in achieving the primary aim of the program, which is to make mid-career scientific professionals involved in agricultural research in developing countries aware of new opportunities available for improving the quality and effectiveness of research through the applications of the new technologies developed in biotechnology.

The program has acted as a catalyst in this respect, as can be seen in the responses to the questionnaires. Many of the graduates from master classes, following further experience through collaboration and participation in other donor funded projects have been able to

pass on the skills and various technologies to other staff and postgraduates in their research groups.. Other master class graduates who are more involved in teaching, or managing and administering research, appear to have a much better understanding of the relevance of biotechnology and are actively supporting the use of this approach in their institutions.

It will not be possible to measure the impact of this transfer of technology for some years, but it is already apparent that the master class program is beginning to have an influence on those mid-career scientists and administrators responsible for the direction and funding of research. The program has correctly identified this target group as they are the important agents for change in the agricultural research systems in the region.

Australia's comparative advantage in providing the master courses in biotechnology, their popularity and catalytic impact on the awareness and use of the new technology, are the grounds on which the review team recommends that the master class program be supported for a further five years.

**Recommendation 1**

> *That the master class program in biotechnology be supported for a further five years as a program under the Crawford Fund, with core support from Australia's overseas aid funds.*

# 5. FUTURE STRATEGIC ISSUES

In its first five years, the master class program has successfully developed an important new area of training, targeting mid-level agricultural scientists who need to keep up with new developments in biotechnology to improve the quality and effectiveness of the teaching and research in their institutions

The program has now reached the stage where it needs to pause and take stock of the rapidly changing environment in which it operates, including the improving research capacity of some of its client countries; the redefinition of its primary target group(s);the changing economic conditions for funding and the interest in broadening the scope and catchment for the master class program.,

Some of the more important of these strategic questions facing the program have been the subject of discussion with the review team and with a selected group of well informed stakeholders. The analysis and the review team's recommendations arising out of the synthesis of these discussions and feed -back from the questionnaires are given below.

## 5.1 Mission, Strategy and Focus of the Master Class Program

The success of the master classes to date has much to do with the high quality of the leadership and teaching staff and the small, lean, non-bureaucratic program, with clear objectives and focus. The instruction has been provided by leading scientists whose time has been donated by their institutions and there has been similar 'in kind' support for the resource persons to assist with the courses and necessary equipment and facilities, In all these respects the program has been extremely cost effective.

Based on the program's track record and the excellent reputation it has earned in Asia, there is general agreement that its mission and goals have been realistic and achievable and that the strategy for achieving its objectives is sound. The program's focus on mid-career agricultural scientists and senior administrators in research and university establishments in East and South Asia has been appropriate for this initial phase of the program. Also there has been full support for the master classes continuing to focus on the role of biotechnology in improving the quality and effectiveness of a wide range of agricultural research activities and continuing as one of the training programs under the Crawford Fund. The only caveat expressed is that the program must remain flexible and modify its strategy as the needs arise, in response to the changes in the operating environment.

**Recommendation 2**

> *The master class program should be flexible and respond to the needs of its clients in its operating environment, but at the same time, maintain the quality, ownership and coherence of the existing program.*

## 5.2 The Funding Environment

In the next 5 years two countervailing influences may effect the funding of the program It seems very likely that some, if not all Australian universities and research organisations, will have to charge for the participation of their staff as course providers in the master class program and possibly for the use of facilities. This will apply particularly to the classes that are contracted by international organisations to achieve a specific purpose related to their objectives.

On the other hand, there are indications that a number of local and international aid organisations (ACIAR, AusAID, IDP. ISNAR, World Bank), would be prepared to contract the program to provide master classes, or to act as a funding partner to organise specific master classes in a particular country or region. Other organisations already offer to pay for the cost of training for individual candidates from developing countries and this form of support may expand, Finally some categories of master classes may charge fees for attendance which would cover the direct costs and those associated with the running of the classes.

The question is, should the master class program become more market orientated and seek out opportunities for 'outside' funding for its program. Some may say that if the program is successful in attracting outside funds, the contributions from the Crawford Fund (aid funds) and other *in kind* sources may decline, however, this may occur independently of the programs ability to earn additional funds. One thing is clear, that additional funds will be required if the program expands the range and frequency of its courses

**Recommendation 3**

> *The master class program in biotechnology should become more market orientated and explore opportunities to raise more funds from national and international aid organisations and others wishing to fund classes intended to achieve improved outcomes in agricultural research.*

## 5.3 Expansion of the Master Class Program in Biotechnology

The current program supports three master classes per year, which provides training for about 45is about 5 to 6 times the number finally selected. From the responses given by participants in the survey, there is a demand for more classes in the courses dealing with the basic principles and core technologies in biotechnology and also the application of biotechnology to new research areas where these techniques are highly relevant. Further, interest has been shown also by local and international agencies in supporting agricultural R&D in developing countries, who are prepared to fund an increase in the number of the existing classes and help develop new topics in biotechnology that would also contribute to the improvement of agricultural research in these countries.

Increasing the number of master classes in biotechnology each year may not present a problem if the current and potential clients were grouped into the following three categories and the classes more closely aligned to their particular needs, as suggested below:-

(a) Senior research managers and administrators in research institutes or universities who have a direct interest in the management and funding of agricultural research. This group

needs a more general course, including basic principles in molecular biology the application of the derived techniques to a range of research fields and the potential benefits for research outcomes. It might also include material on bioinformatics, with reference to biotechnology, the management of intellectual property and regulations for biosafety of genetically modified plants.

(b) Mid-career research leaders from agricultural research institutes and university faculties who have responsibilities for research groups and/or postgraduate students in their institutions, These scientists often need a more specialised course, including instruction in the basics of molecular biology and the application of these technologies to the more specialised fields of research relevant to their research organisation, such as pest management in crops, improved animal vaccines; and the role of genetic markers in plant breeding.

(c) Top level agricultural leaders and decision makers involved in the broad areas of agricultural research policy, funding and development, from either the public or private sector. These decision makers will be attracted to a short course on the role of biotechnology as an enabling technology in agricultural research, its benefits and possible disbenefits, and its significance at the strategic planning level. This could be achieved by using a case study approach which could also introduce issues relating to intellectual property and biosafety

The current classes tend to make little distinction between groups 1 and 2, especially those classes that deal with more disciplinary orientated topics. Providing a separate course for each of these groups, specifically tailored to their needs, would overcome some problems relating to the adequacy of prior training and experience which were raised by the participants. The course for the group involving senior managers and administrators, who do not participate directly in research and who have broader research interests, could possibly be reduced from 3 to 2 weeks. The third group, the decision makers, can probably only spare 3ys to attend a class because of their special responsibilities.

Recognising these specific groups of clients would automatically expand the number of master classes that could be offered, but the extra cost would not necessarily be in proportion, as the average time per class would be lower. Also, some of the costs associated with the classes may also be reduced by charging the participants part or full fees, especially the senior group of decision makers This would not restrict the opportunity to obtain full or partial funding for a course, or to undertake partnerships under certain circumstances, however, with any expansion in the number of topics and classes and the growth in external funding, care must be exercised to retain the responsibility, or ownership of the program and the high quality of the scientists involved in the teaching activities.

**Recommendation 4**

*The number and types of the master classes in biotechnology should be increased to respond to the perceived needs of the three major classes of clients; senior managers and mid-career scientists associated with agricultural research and top level agricultural leaders and decision makers Any such expansion of the program should be conditional on the availability of the necessary human and financial resources.*

## 5.4 Follow-Up Activities

The lack of a formal cost effective follow up strategy for the master classes is a challenge for the program and some effective support package in this area would greatly enhance the value of the classes. This is especially true for those attending the more specialised classes that focus on the application of the new technologies to particular research areas or disciplines. In these cases funds should be built into master classes for this purpose.

Several approaches are suggested to help overcome this problem:-

(a) Provide access to the internet in institutions where this is not available, and instruction on how to operate, so as to acquire electronic mail facilities and the opportunity to use information and data bases on all aspects of biotechnology and other related fields. This could open up new opportunities for informal networking among former participants, direct access to course providers for follow up information and links to other established biotechnology networks in the region. In some cases the provision of a local internet server may be difficult, but in most of the major cities in the more advanced countries in Asia, these facilities are available, or will be in the near future.

(b) Develop project 'mentors' in selected institutions who could be given additional training and experience if needed, so that they can act as support persons in a region for others who are graduates of the master courses. They could be given modest resources to contact these scientists, especially the graduates of the more specialised master classes, to provide advice and problem solving services. In certain cases they could visit other institutions in the countries to provide the 'hands on' assistance as needed. The project mentors could also be asked to distribute hard copies of particular information such as the CABI data base on agricultural biotechnology publications which is available on CD. Self teaching videos might be developed to use during the classes and to leave with the mentor to help them refresh their understanding and those of their colleagues and students. Also, It may also be possible for the mentors to participate in future master classes in the region and possibly spend 3ng further experience in molecular biology at advanced institutions, in or out of the region. In time they could be encouraged to run their own master class program to take over from the existing Crawford Fund master classes in their region.

(c) PhD fellowships might be provided to allow selected students of the mid-career scientists attending master classes to undertake further training partly in Australia, co-supervised by one of the course presenters. Special funding for this purpose may come from a number of sources.

**Recommendation 5**

*Efforts should be made to develop a more formal approach to provide effective follow-up(possibly along the lines suggested), for the graduates of master classes in biotechnology who are in a position to apply the knowledge and skills acquired in improving their own research and that of the group under their supervision. Funds should be provided as part of the relevant master class project for this purpose.*

## 5.5 Geographic Priorities for Participants and the Location of Master Classes

*Catchment Areas*

The choice of countries and regions from which participants are selected needs consideration. Up to date the catchment has been East Asia and to a lesser extent South Asia with a total of 14 countries represented in these regions. Six countries Thailand, Australia, Indonesia, Malaysia, Philippines and Vietnam have supplied a little over three quarters of the participants.

East and South Asia are appropriate regions from which to draw participants, as the countries in these regions are in the agreed focus for Australia's aid program. In the future, as these countries develop and expand their capabilities in biotechnology, especially those such as Malaysia, China and Thailand, the program will need to become more selective with applicants, especially for the more research orientated master classes, involving mid career scientists, Increasingly the people from these more advanced countries will have the necessary training and skills and the selection should focus more on those countries who are in the process of building their research capacity and need advice on how best to utilise the new technologies emerging from biotechnology in their agricultural research. As virtually none of these countries are training senior research administrators and decision makers, master classes designed for these mid career professionals can draw on applicants from any of these countries

Outside the Asian region there may be opportunities for all three types of master classes in South Africa and in the SAC group of countries in Southern Africa, provided the necessary funds are available, preferably from donors who wish to support the application of biotechnology in the agricultural research in these countries. Spreading the net too widely, however, could easily exceed the capacity of the master class program to provide the necessary staff and funding and therefore any move in these directions should be in response to demand and undertaken with care.

*Locations for Conducting Master Classes*

The previous locations of master classes and the rationale for this has been discussed earlier,

however, with the suggestion for the expansion in the types of master class in biotechnology, the locations in which they are held may become more important. It has been necessary to hold those classes involving practical exercises and needing sophisticated laboratory equipment and reagents and trained resource staff, in locations where these facilities are available. These can be found either in Australia or in advanced laboratories in the Asian region. Where the class requires specialist material and facilities not available in any other laboratory, it is best held in such a specialist laboratory with the responsible scientist managing the course.

For courses designed for senior administrators and decision makers, where there are less 'hands-on' practical exercises requiring specialised equipment, the location of the classes is less critical. A developing country location may have an advantage, as it can provide direct access to conditions and situations in which the participants themselves work and it may make it easier for the more senior administrators and decision makers, whose time is limited, to attend

**Recommendation 6**

*The major catchment for candidates to undertake master classes should remain in the developing countries in the East and South Asian regions, but the choice of countries should be flexible, with decreasing emphasis over time on those with the most advanced economies and strongest programs in biotechnology. There are also good opportunities outside these regions in Southern and South Africa, especially if additional donor funds are available to defray the higher costs involved.*

**Recommendation 7**

*Master classes in biotechnology designed to transfer specific technology and skills for application in research, need to be held in well equipped laboratories either in Australia or in the Asian region Other classes designed to raise awareness in senior research managers and decision makers are less restricted and can be held in most countries, but with a preference for a country in the region where most of the participants are located.*

## 5.6 Management of the Master Class Program

The master class program is managed by a Coordinator under the auspices of the Crawford Fund at minimal cost, largely because of the expertise of the coordinator and the persons extensive understanding of the field and knowledge of who's who in biotechnology. This point is made because the skills of the Coordinator and the persons standing with his colleagues in the field, has a great deal to do with the quality of those recruited to provide the class material and with the overall strength and quality of the program.

The evaluation committee fully supports the style of management adopted by the Crawford Fund and its programs, which operates with a minimum of bureaucracy, clear delegations and considerable flexibility. At the same time, there is a belief that the Coordinator of the master classes in biotechnology would benefit from access to advice from professionals in the field and greater support in the administration of the program.

The suggestion is that a small advisory subcommittee of the Board of Management of the Crawford Fund be set up, with the following structure and responsibilities:-The committee might be chaired by an appropriate member of the Board and made up of two to three persons plus the Coordinator of the program, with powers to co-opt. The subcommittee would meet at least once per year and its role would be to advise the Coordinator on the plans for the annual program of work and budget, and on any other strategic issues involving the program and its activities. Further secretarial support, in addition to that provided by the fund, might be arranged through a part time appointment, with funding where possible from overheads earned from contracting training services.

**Recommendation 8**

> *Consideration should be given to the formation of a small subcommittee of the Board of Management of the Crawford Fund to advise the Coordinator of the master classes in biotechnology on program and budget and other strategic issues Further secretarial assistance for the Coordinator should be considered to support any proposed expansion of the program.*

## 5.7 Collaboration With ACIAR

ACIAR has been the major supporter of the master class program since its inception as a component of an ACIAR project and subsequently when it became a program under the Crawford Fund. In many ways, during this entire period, the master classes have been regarded by ACIAR, as *de facto* a part of the training component of the Centre's biotechnology program.

In a report commissioned by ACIAR and published in 1995[2] it is recommended that '*ACIAR give consideration to funding short, in situ courses in selected institutions in partner countries which can serve as regional centres of excellence, in order to develop and integrate biotechnology capability into the existing research strengths of institutions in partner* countries --------'.

This recommendation provides a useful framework for the continuation of ACAIR's use and support of the master class program. Biotechnology has the capacity to contribute new tools and technology to many of ACIAR's research projects. Upgrading the capacity of ACIAR's research partners in this area will help to achieve this outcome.

As in the past, ACIAR can be pro-active in suggesting to the Coordinator of the master classes the need for particular biotechnology training, including the potential participants and a possible venue for the classes. Alternately the Centre can support the participation of acceptable candidates in regular scheduled classes. With the close linkages that exist between ACIAR and the Crawford Fund, ACIAR's continuation of its effective support and collaboration in training is highly desirable,

**Recommendation 9**

> *The evaluation committee strongly endorses ACIAR's continued collaboration and support for the master class program in biotechnology and sees mutual benefit in continuing to regard it as a component of the Centre's training program.*

## 5.8 Expanding the Master Class Model to Cover Additional Research Topics.

The term master class, although first used in connection with biotechnology, is a generic term to describe a particular type of training in which mid-level professionals and other senior administrative staff in the same general field of research are brought up to date with new developments in a rapidly moving area research. Largely due to the success of the existing

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**[2] Biotechnology and its Implications for ACIAR. ACIAR Technical Report No 35**

master classes in biotechnology, interest has been shown by aid agencies in supporting master classes in additional areas of research and development in agriculture to fulfil training objectives in their own programs in developing countries

There is no reason why further master class programs, in addition to the program in biotechnology, should not be developed as part of the future training strategy of the Crawford Fund. Provided that any new master class program is attractive to the potential clients and that additional sources of funding can be found, its adoption would help to broaden the training base and add to the variety of activities in the Crawford Fund. Some of the criteria that might be used to ensure the suitability of such an initiative might be :-

- The ability to contribute to agricultural research and sustainable development, in Australia and in the developing countries of the Asia region.
- Australia's comparative advantage to provide world class instruction in the particular topic, and at the same time, retain ownership of the program.
- The ability to coordinate the program and to obtain the necessary support and advice, to develop a well planned relevant program.

**Recommendation 10**

*The generic title of 'master class' could be used to describe a range of training programs in research and development areas of agriculture, with similar objectives to the current master classes in biotechnology, under the management of the Crawford Fund.*

# 6. SUMMARY AND CONCLUSIONS

The master classes in biotechnology were designed to raise the awareness of the potential of biotechnology to improve the efficiency and outcomes of agricultural research in developing countries. This represents a new and innovative training program, targeting the mid-career scientists and senior research managers in countries in Asia, to help them upgrade their understanding of the field and the value of the new technologies in facilitating the research activities in their institutions.

During the last five years, the master classes have achieved a solid reputation for quality and effectiveness and there is a strong demand in the region for a greater frequency of courses covering a wider range of applications in agricultural research. The results of the detailed survey of those involved in the courses and associated stakeholders, indicated that the classes were well designed and highly relevant to the research and teaching needs of the participants.

The classes have clearly demonstrated the enabling role of the new technologies and their application to a wide range of current research in the region. Also, although modest in size, the program has had a significant catalytic effect through its influence on teaching and research. Other benefits in addition to capacity building, have been the new opportunities for course graduates to develop collaboration with biotechnology groups in their own institutions and outside their own region. Many graduates have also been motivated to seek further training, often overseas, and have been successful in obtaining additional research grants.

Australia's comparative advantage in providing master classes in biotechnology, the strong demand and the positive impact they appear to be having on the adoption of new technology, are the grounds on which the evaluation team has recommended that support for the program continue for a further five years as a component of the Crawford Fund's training activities

Important strategic issues for the future include the possibility of expanding the scope and number of master classes within the current focus of biotechnology, to cater more effectively for the needs of the different types of clients. These include mid-career scientists, senior research administrators and top level decision makers associated with research and development in agriculture. Any increase in the size of the program will require additional resources, which are most likely to be obtained from the international aid community and to some extent from the clients, who in some cases may be prepared to share a greater proportion of the cost of running master classes. ACIAR's strong support for the master classes has been a key factor in their development. The evaluation committee encourages ACIAR to continue supporting the program and using it to satisfy the training requirements within the Centres own programs

The broad Asian catchment for the candidates for master classes should not change, but the rapid evolution of some of the countries within this region, such as Malaysia, China and Thailand, should cause the focus to move more to the next generation of countries that are developing their agricultural research and are more in need of support. With a greater differentiation in the different types of master classes, it should be possible to hold more of the classes, which have less requirements for specialised equipment and materials, in the region under conditions which are more realistic and convenient for the more senior participants, whose time is often limited.

Along with support for an expansion in the program, there will also be a need to provide an advisory mechanism to assist the Coordinator in various aspects of priority setting and the selection of suitable training staff. Also, additional secretarial support may be needed to help with the added work load.

The other important issue that will require additional support is the need for a more effective, cost efficient follow up program, especially for those wishing to have the new technology applied in their research programs. Some suggestions in this regard are made in the report.

The success of the current master class program, and its favourable impact, suggests that this approach to the training of mid-career professional may be successful when applied to other areas of research and development in agriculture. Provided any new master classes maintain the quality and relevance of the current program, it should succeed and could add a further dimension to the Crawford Fund's teaching activities.

# 7. LIST OF RECOMMENDATIONS

**Recommendation 1**

*That the master classes in biotechnology program be supported for a further five years as a component of the Crawford Fund, with core support from the Australia's overseas aid program.*

**Recommendation 2.**

*The master class program should remain flexible and respond to the needs of the clients in its operation environment, but at the same time maintain the quality, ownership and coherence of the existing program.*

**Recommendation 3**

*The master class program in biotechnology should become more market orientated and explore opportunities to raise more funds from national and international aid organisations and others, wishing to fund classes intended to achieve improved outcomes in agricultural research.*

**Recommendation 4**

*The number and types of master classes in biotechnology should be increased to respond to the perceived needs of the three major classes of clients ; senior managers and mid-career scientists associated with agricultural research and top level agricultural leaders and decision makers. Any such expansion of the program should be conditional on the availability of the necessary human and financial resources.*

**Recommendation 5**

*Efforts should be made to develop a more formal approach to provide effective follow-up for the graduates of the more specialist master classes in biotechnology, who are in a position to apply the knowledge and skills acquired to improving their own research or that of the group under their supervision. Funds should be provided in each relevant master class project for this purpose.*

**Recommendation 6**

*The major catchment for master classes in biotechnology should remain in the developing countries in the East and South Asia regions, but the choice of countries should be flexible, with decreasing emphasis over time on those with the most advanced economies and strongest programs in biotechnology. There are also good opportunities outside these regions in Southern and South Africa, especially if additional donor funds are available to cover the higher costs involved.*

**Recommendation 7**

*Master classes in biotechnology designed to transfer specific technology and skills for application in research, need to be held in well equipped laboratories either in Australia or in the Asian region, Other classes designed to raise awareness in senior administrators and decision makers are less restricted and can be held in most countries, but with a preference for those in the region where most of the participants are located.*

**Recommendation 8**

*Consideration should be given to the formation of a small subcommittee of the Board of Management of the Crawford Fund to advise the Coordinator of the master classes in biotechnology on program and budget and other strategic issues. Also further secretarial support for the coordinator should be considered in the event of any expansion of the program.*

**Recommendation 9**

*The evaluation committee strongly endorsed ACIAR's continued collaboration and support for the master class in biotechnology and sees mutual benefit in continuing to regard it as a component of the Centres training program.*

**Recommendation 10**

*The use of the generic title of 'master class' could be used to describe a range of training programs in different research and development areas of agriculture with similar objectives to the current master classes in biotechnology, under the management of the Crawford Fund.*

## ANNEX 1

### CRAWFORD FUND MASTER CLASSES IN BIOTECHNOLOGY: A tracer study of participants, their sponsoring institutions and course providers

## A1.1 BACKGROUND

This report presents the findings of a Tracer Study carried out on past participants of Crawford Master Class participants, their sponsoring institutions and course providers.

The Tracer Study was carried out in mid 1997 through survey questionnaires designed for each respondent group. The distribution of questionnaires was by mail. In the countries where ACIAR has country managers, the managers assisted in following up non-respondents.

The report is one component of an overall evaluation study of the Crawford Master Fund program carried out under the chairpersonship of Dr James McWilliam.

## A1.2 MEMBERSHIP OF THE STEERING COMMITTEE

Design of the Tracer Questionnaires, analysis of the results and preparation of this report was carried out by the Steering Committee consisting of the following:

Dr James McWilliam, Chairperson
Mr Larry Marlow, Marlow Hampshire
Dr Ratana Sdoodee
Godfrey Lubulwa, ACIAR
Susan McMeniman, ACIAR

The helpful comments and suggestions made by Dr Bruce Holloway and input from Mr Bill Pennington and Ms Lyn Richards, from AusAID are also acknowledged.

## A1.3 SAMPLE

Questionnaires were sent to each of the three groups involved in the Crawford Fund Master Classes: Participants, course providers and Institutions.

The return rate percentage for each of the groups is listed below:

| Group of respondents | % of population | Number of respondents (n) |
|---|---|---|
| Participants: | 72% | 92 |
| Institutions: | 59% | 62 |
| Course providers: | 30% | 16 |

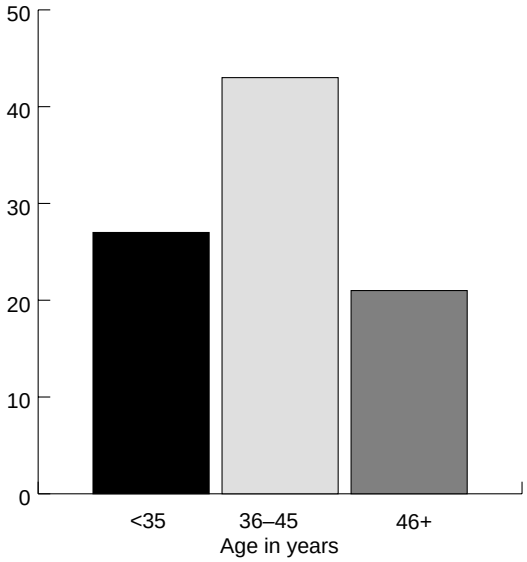
Questionnaires were posted to about 150 individuals who participated in master classes from their inception in 1992 to early 1997. The heads of institutions which sponsored course participants were also asked, using a separate questionnaire, to comment on various aspects of the master classes. Finally course providers were sampled to obtain their opinions on another set of questions.

## A1.4 FINDINGS

### A1.4.1 Findings Master Class Participant Questionnaire (Question 1 to 18)

*Question 1. Age of participants*

The numbers at the top of the bar chart below gives the number of participants in a given age group.



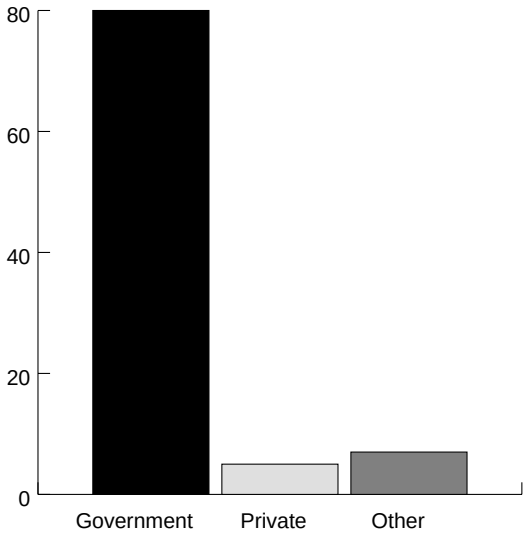

* One person did not respond to this question

*Question 2. Country of current work of participants*

| Name of country where participants are currently working | Number of participants working in the country |
|---|---|
| Australia | 10 |
| Brazil | 1 |
| India | 5 |
| Indonesia | 11 |
| Malaysia | 8 |
| Nepal | 1 |
| Philippines | 11 |
| Sri Lanka | 5 |
| Thailand | 19 |
| Vietnam | 7 |
| Not stated by respondent | 1 |
| Total | 79 |

The majority of participants came from south east Asian countries, with 21% coming from Thailand.

*Question 3. Institution in which currently employed*

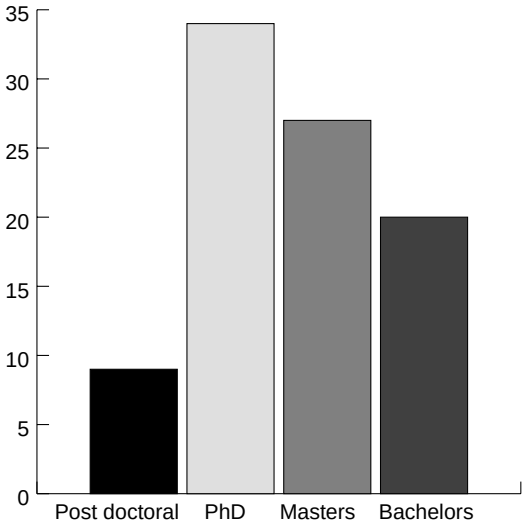



Over 87% of participants work for Government organisations, 5% work for private institutions and 7.6% work for other types of institutions. (These may be because of some confusion with the terms government and private)

*Question 4. Institution which employed you when attending Master Class(es)*

A number of participants (83.7%) are still working for same institutions that sponsored them attending the master class. Only 14 participants had changed organisation, of those many had moved location within the same organisation

*Question 5. Highest academic qualification*



*Question 6. Area of specialisation*

| Area of specialisation | Number of participants in the area |
|---|---|
| Genetics | 8 |
| Plant breeding | 12 |
| Animal breeding | 4 |
| Biochemistry | 5 |
| Plant pathology | 36 |
| Entomology | 0 |
| Microbiology | 16 |
| Reproductive biology | 2 |
| Agronomy | 1 |
| Post harvest studies | 0 |
| Other | 15 |
| Total | 99* |

* 6 people selected more than one area and one person did not indicate an area

By far the most commonly selected area was Plant Pathology (over 36%), followed by Microbiology (16%). Other categories included the following:

- Plant inspector
- Animal production (large ruminants)
- Veterinary Medicine
- Plant tissue culture
- Animal Product Technology
- Plant Physiology, (weed science)
- Dairy Technology (2)
- Plant Physiology
- Molecular Biology
- Plant Quarantine
- Food & Dairy; Animal Science
- Plant Molecular Biology & Biotechnology
- Conservation of genetic resources

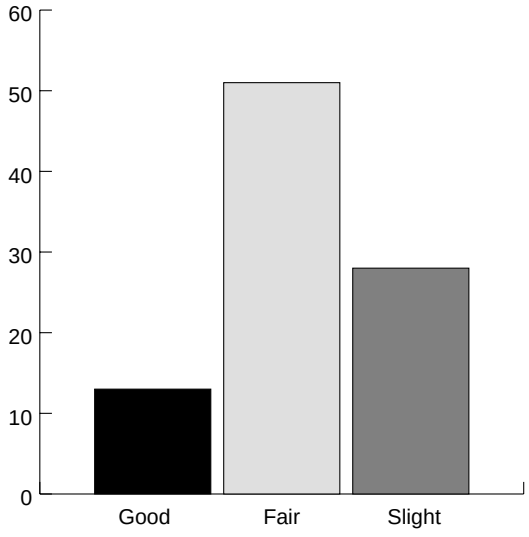
*Question 7. Have you attended other Biotechnology (molecular biology/genetics) training courses in the past five (5) years?*

Eighteen people (19.6%) had attended another course, one of those people had attended two courses. Two of the 18 people (11%) indicated the course was more suitable than the master class, 13 (72%) stated it was equally suitable, two (11%) people did not indicate how the course compared, and only one considered it less suitable. One person did not list any details of the course they attended.

The courses attended are listed below:

| Course Title | Location | Date |
|---|---|---|
| Training course on Recombinant DNA Technology | IBS UPUB College Laguna, Philippines | April 1997 |
| A computational molecular biology and molecular bioinformatics | NECTEC | January 1997 |
| Molecular of chromosomes and genes (human and animals) | Chiang Mai and Mahidol University, Thailand | 1996 |
| Cytoplasm diagnosis | Bogor | Nov 96 |
| Plant genetic resources | Japan | October 96 |
| Org'n & Mgt of seed production and supply | Svalov, Sweden | Aug–Oct 1996 |
| Detection of bacterial pollution using biotechnology techniques | Bogor | July 95 |
| Detection of BW using Elisa and PCR techniques | Bogor | July 95 |
| BT Technology | Institute of Biotechnology, Malaysia | March 95 |
| Protein Workshop | UPM Serdang | Nov 94 |
| Modern techniques in the identification of Bacteria and filamentous fungi | UK | Oct–Nov 1994 |
| New approach to control Bacterial Wilt | Queensland University | July 93, Jan 94 |
| Molecular genetic of lactic acid bacteria | Food Tech Centre, University College Cork Ireland | June 94 |
| Molecular aspects of *P. solanaceum* | Brisbane | 1994 |
| Workshop for plant pathology using Genetic Engineering | Korea | December 93 |
| Non-radioactive DNA probe for diagnosis of leaf curl virus | Thailand | June 93 |
| Advanced PCR technology today | Bangkok | April 93 |
| Biodegradation | Yogyakarta Indonesia | Feb–Mar 1993 |

*Question 8. Before attending the Crawford Fund Master class what was your understanding and experience of molecular biology and/or the topic of the course?*



*Question 9. What led you to apply for and attend a Master Class in biotechnology?*

| | |
|---|---|
| **Improve my knowledge and skills in research/teaching in the area of molecular genetics/biology** | 58 |
| Increase understanding of biotechnology to enhance collaboration with researchers in this field | 20 |
| As a manager and co-ordinator of biological research I needed to know how this new area of research could assist my Institute's program | 7 |
| To advance my professional career | 7 |
| At the request of my Institution/Employer | 5 |
| Other | 4 |

* 5 people selected more than one response

Other reasons included:

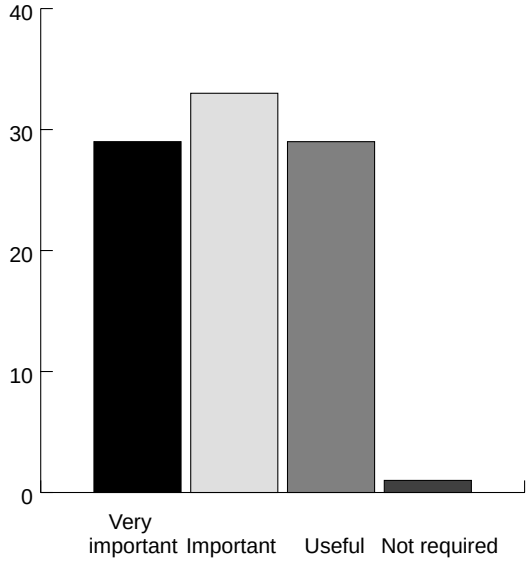
- To obtain knowledge of molecular approach can help solve problem that cannot be tackled by conventional approach
- Improve my knowledge and skills in research/ teaching in the area of dairy technology
- Increase practise on biotech in collaboration with my plant breeding work
- Nominated by the Regional Coordinator of Asian Biotechnology and Biodiversity (ABB) subprogram of FARM program

*Question 10. What is your retrospective overall assessment of the Master Class in Biotechnology that you attended?*

Mean score 3.94

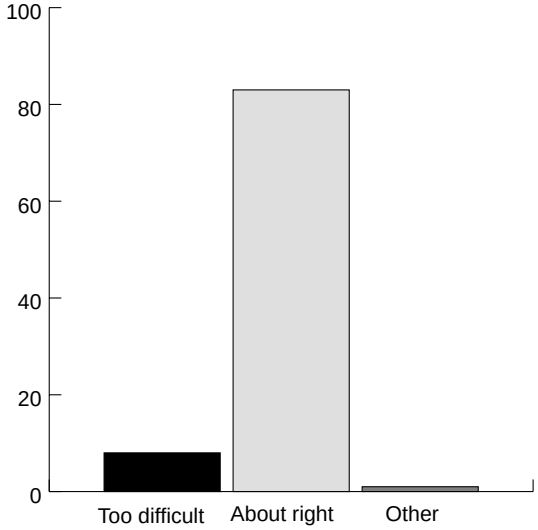
The majority of responses (94.6%) indicated their overall course assessment was between satisfactory and excellent. Five (5) people indicated they were not satisfied with the course.

*Question 11. To get a maximum value from the course, how important was it to have had previous research/teaching experience in the basic principles of the Master Class:*



98.9% of respondents indicated that previous research or teaching experience was of some importance. Only one respondent indicated it was not required.

*Question 12. Within the time available for the Master Class, did you find the course content*




Most respondents (90%) considered the course content to be ‘about right’ with only 8.7% indicating it was too difficult.

*Question 13. Did you find the balance between lectures and practical exercises:*

| | |
|---|---|
| About right | 41 |
| Need more lectures less practicals | 5 |
| Need more practicals less lectures | 38 |
| Other | 6 |
| No response | 2 |

A surprising 41% of responses indicated a need for more practicals. Several of those who selected ‘other’ as an option indicated they would like both more lectures and more practicals.

*Question 14. What benefits (if any) did you obtain from undertaking the Master Class.*

| | |
|---|---|
| The information and new skills obtained has enabled me to improve my efficiency and research technique and has opened up new possibilities for my research program in biotechnology | 57 |
| I now appreciate the role of biotechnology in my own field of research and the advantages and opportunities for greater collaboration with colleagues both nationally and internationally | 39 |
| The course has improved my understanding of the important role of biotechnology in many aspects of agricultural research. Now, as a research coordinator and manager I am better able to see how to integrate this new technology into our research program | 17 |

| | |
|---|---|
| The course has expanded my understanding and appreciation of the role of biotechnology in our future research, but at present there is no way of introducing biotechnology into our present research program | 11 |
| Because I had no prior training or experience in the scientific disciplines that are a prerequisite for this course I found it difficult and of little or no relevance for my own scientific activities | 2 |
| Other | 4 |

* Respondents were able to select more than one option

Other benefits included:

- Valuable information and practical skills acquired but difficulty implementing the technology due to number of reasons mainly related to placement of work.
- Technical exposure to new advances in livestock production and appreciation of the role of biotechnology
- Made contacts with several Australian Dairy companies exporting milk to Malaysia
- Our office are buying equipment for set up molecular biology lab

*Question 15. Have you experienced any difficulties in implementing the information and technologies acquired from the Master Class on return to your organisation?*

There were 54 responses to this question, indicating that 58.7% of people had some difficulties.

| | |
|---|---|
| I am unable to exploit the technology because my institute lacks the advanced equipment and materials needed | 44 |
| My Institute/Faculty does not have a biotechnology group to which I have access | 10 |
| I have received a promotion to an administrative job which allows me little time for research/teaching | 3 |
| My research program has been changed and I no longer have reason to link up with the biotechnology group in my Institute | 1 |
| Our Institute has determined that research or teaching in biotechnology should not be a priority for the organisation | 3 |
| Other | 11 |

* Respondents were able to select more than one response

Other reasons included:

- Need some more colleagues trained in this field of biotechnology
- Although we have a PCR machine, we cannot afford to buy enzyme, polymerase and primer very often
- Lack of research fund for buying expensive biotechnological chemicals and materials
- The technologies in molecular genetics have been changed rapidly
- Limited funds

- My institution is funded by overseas development administration of UK government, but funds are available to purchase basic equipment.
- I am using techniques to study Psolanacearum genetics and its interaction with its host leading to wilt.
- Getting funds for research is a problem, biotechnology projects need expensive equipment and consumables.
- My master class experience will be tested this year (1997) in our new biotech lab
- Lack of funding
- We have the funds but due to certain purchasing procedures the process of acquiring equipment has to be delayed

*Question 16. Do you think that any of the difficulties you have experienced would have been reduced by follow-up by the Crawford Fund?*

43 of the 54 who experienced some difficulties, ie 79.6% of respondents to this question believed some form of follow up would have reduced difficulties experienced implementing the information and technologies acquired from the Master Class.

*Question 17. After completion of the course have you had reason to do one or more of the following as a follow-up?*

| | | |
|---|---|---|
| Contact teaching staff | 37 | 40% |
| Contact other course participants | 54 | 59% |
| Visit Australia for follow up | 16 | 17% |

*Question 18. Indicate which, if any of the following would have been helpful after the course*

| | | |
|---|---|---|
| Correspondence by post or electronic means | 55 | 60% |
| Visit by teaching staff or other specialists | 35 | 38% |
| In-country meeting | 19 | 21% |
| Other | 18 | 20% |

Other follow up

- In-service training to specific interest
- Develop collaborative project to make practical use of the techniques learned.
- To collaborate with other course participants in research program.
- Newsletter, names, positions and contact details of all people whom now completed the Program.
- Since then I have requested ACIAR Link program for application of B/T for IPM but could not proceed.
- Supporting some needed equipment or chemicals (markers, antibodies, antiserum etc)
- A research grant to carry out even a small project.
- Further training in Australia
- I was able to get a research grant from Department of Science and Technology after my training in Australia

- Information related to existence of collaborative research provision or other training programs will be appreciated.
- A provision to continue researching in Australia in a short/long term project.
- ACIAR to work out research collaboration to help upgrade laboratory facilities to do molecular biology research.
- Assistance in the form of monetary to acquire equipment to implement the technology.
- A more advanced course
- Exchange of ideas with local researchers.
- Bio-information search and data analysis by computer on-line
- If possible fund made available to build national capacity in Biotechnology in the National Research System
- Arrange another advance course in related area to the first Master Class

### A1.4.2. Findings: Institutional Questionnaire (Questions 1 to 9)

*Question 1. As a result of attending a Master Class (MC) to what extent do you believe that staff have improved their research or teaching skills*

The overwhelming majority (95.45%) of responses fell between Moderately and Significantly with only two responses indicating there was Insignificant to Moderate improvement.

Mean 7.16*

* These figures use Significantly = 10, Moderately = 5 and Insignificantly = 1

*Categories of Improvement in Research or Teaching Skills*

- Better scientific research understanding
- Improved ability to obtain relevant information
- Better laboratory work
- Enhanced ability to prioritise research topics
- Better analytical skills
- Enhanced understanding of others
- Increased autonomy
- Able to train others in techniques
- Improved versatility in techniques
- Enhanced collaboration with other researchers
- Increased confidence in teaching
- Increase in enthusiasm about conducting research and teaching activities
- Enhanced job effectiveness
- Increased research networks
- Increased knowledge and sharing of research
- Application of core technologies
- Catalyst for long term change
- Attraction of overseas fee paying students to Australia

*Verbatim comments*

— Research on milk processing in collaboration with Provincial government of East Java. Lecture note on cheese processing.
— The candidate has a much better understanding of and appreciation for conducting exact and accurate scientific research
— From his ability to obtain latest information/ publications and teaching qualification

*Laboratory work; Teaching method*

— The MC has opened the horizon of the scientist in biotechnology research. It is expected that continued support could be provided including necessary facilities to implement the knowledge gained in the form of a research project. It is also the institutes interest that he could prioritize relevant research topics in efforts to increase agriculture production.
— To improve knowledge and skills in the area of molecular genetics/ biology for quarantine purposes in the screening of pests and diseases
— They are more objective in their approach. Possess better analytical skills and more attentive to details.
— Better understanding of molecular biology.
— The staff member now spends more time in a gene mapping project. He also has a greater appreciation of the benefits biotechnology can bring to enhance his current breeding program.
— General improvement in research skills.
— The Master Class provided a firm foundation on which we could build further understanding and further skills.
— Significantly because the staff was updated on what is new in the field.
— Others have been made aware of the need to update our R&D along biotechnology or molecular approaches.
— We lack fund and facilities to go on with this specialised molecular research.
— They have improved their knowledge, research skills and practical approach in doing their own work.
— The participant was involved in organising regional training of artificial insemination technicians wherein she was able to apply skills and knowledge learned during the course.
— Gave me a better appreciation of the technologies involved.
— Appreciation of techniques and capability of biotechnology.
— This has helped the candidate to be versatile in the various biotechnological technique.
— Increase understanding of biotechnology to enhance collaboration of our staff with researchers in this field.
— He gains more experiences in research methodology and acquires some new knowledge and technology in molecular biology of plants.
— He seems to be more confident in teaching subjects related to plant molecular biology especially in practicals. He also has been writing up a teaching module in molecular plant pathology using some of the experiences gained from the MC. The publication and organising the course are sponsored by the European Community (EC).
— She improved and skills in research because she opened up new research program in Molecular biology.
— Increased self confidence and research ability.

— New knowledge on reproduction. Collaborate with researchers of Tropical Beef Centre (CSIRO). Adjust and adapt for our training course.
— By providing practical and high level skills to our participant which they can immediately apply in their research. By direct exposure of participants to modern laboratories and facilities.
— With practical experience and hands on training, the staff became more enthusiastic and confident about conducting research and teaching activities on molecular biology.
— Increased knowledge and exposure to recent techniques.

*Teaching skills.*

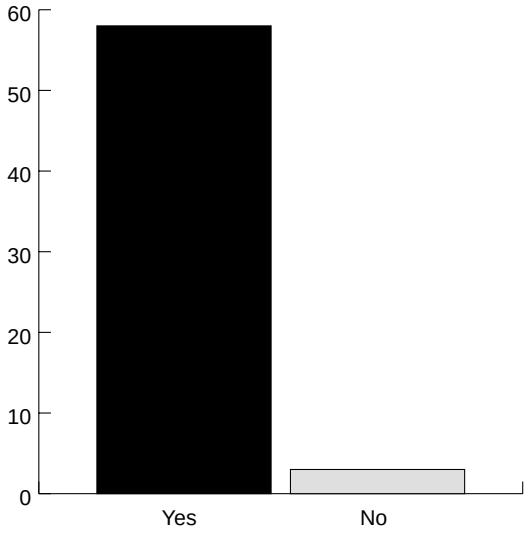
— Teaching skill, she can extend her knowledge, particularly new information/ new technique to students who enrolled the courses of Microorganism in Plant Diseases, Bacterial Diseases of plants and other relevant subjects.
— New skills and understanding; Greater confidence; Additional contacts.
— In tissue culture field: finding the suitable ratio between auxin/cytokinin for shoot induction and multiplication of some forest tree species such as *Acacia* hybrid, *Eucalyptus* sp., *Chukrasia tabularis*.
— A greater understanding of the theory and practical use of molecular techniques was achieved by her. This was important because she had just commenced a PhD study and had no previous experience in the subject area.
— They now use DNA technology in assessment of some pathogenic fungus and bacteria. The participants have improved their theory and practice.
— I have asked the participant for Plant Gene Technology to mark this assessment. In that particular course, the participant has some experience to certain degree. So she scores ‘Moderately’. However, in Master Course in Virology, I scores ‘Significantly’.
— As a result of attending give me knowledge of the new technology that I can apply to my work.
— He has improved his research work and teaching skills to a higher level. This is observed from his research topics and teaching handout which improved very much.
— Has incorporated some aspect of molecular techniques in plant disease research as well as teaching.
— Attempts have been made to include biotechnology in research and teaching.
— I can see a better understanding of research carried out.
— The master class has provided the participant with molecular techniques needed as the background of her main job at the Research Institute for Tobacco and Fibre Crops (RITFC).
— He has the exposure and experience from the training but some of the facilities and machinery are not within his control
— One participant who was trained as a medical molecular biologist, became more confident with plant systems. The other participant obtained much needed hands on experience with some molecular techniques to support interest in Biodiversity.
— It allowed better communication with researchers from other research institutes or Universities, with implementation of collaborative projects.
— The participant attended a Master Class to better understand basic knowledge on microbial and plant molecular genetics and learn technology on molecular biology.

— The molecular biology techniques learned at the course have been applied to current research projects on diseases of ornamental plants.
— The scientist was highly motivated with the advanced areas of plant molecular biology being pursued in Australia.

*Revision of course contents*
— As a result of attending the master class, my staff member can do research on molecular genetics on his own.
— The staff has shown himself as a much more skilled and clearly leading an independent research worker.
— The knowledge that he gained from the course will be very useful especially on supporting the institute research program, which aimed on the microbial genetic engineering research activities.
— This course enable him improve the experimental efficiency and skills, expand the understanding of the international agricultural biotechnological trends, and learn the bio information search by online computer (internet) which was not equipped with in our centre in that time.
— The staff can use the knowledge from training in teaching and research
— My staff have more confidence for doing the research in this field. She can set up molecular laboratory in our centre after attended MC training course.
— The staff who attended the training is pursuing research on molecular mapping of bacterial wilt resistance in forests. The Crawford fund course was invaluable in providing skills to undertake the research and to appreciation of the molecular genetic of ? pathogen information.
— Since he works in private company such that he is not teaching students but his company accepts students and farmers for training. So he has ability to train them.

General comments were that participants improved knowledge and skills in research, particularly analytical skills improved appreciation of technical and theoretical aspects of biotechnology.

*Question 2. From your impression was the course that your staff member attendedrelevant and useful to your Institute's objectives*




Comments—An overwhelming majority said that the course that the staff member attended was relevant and useful (93.2%).

Attendance at this program appeared to assist at an institutional level in realigning R&D priorities. Developing projects, acquisition of basic equipment and increasing networking with new colleagues and institutions.

*Question 3. Please list the 3 most important New Biotechnology topic areas of value to your Institutions objectives?*

Areas of New Biotechnology topic areas nominated by respondents, summarised by theme were:

| **PRIORITY 1** | |
|---|---|
| **Plant Topics** | **Animal Topics** |
| Diagnosis of Plant pathogens (8) | Genetics, reproduction cloning (6) |
| Development of disease resistance in plants (5) | Animal nutrition (microbial/feed) (1) |
| Molecular markers for genetic analysis and breeding (5) | Vaccine production (1) |
| Plant tissue culture for plant improvement (3) | Genetic Engineering (microbial) (3) |
| Crop improvement (3) | Genetics, reproduction cloning (6) |
| | Other |
| | General (core) molecular biology (4) |
| | Bioremediation (1) |
| | Biofertilizers(1) |
| **PRIORITY 2** | |
| **Plant Topics** | **Animal Topics** |
| Development of diseases/Resistance in plants (6) | Microbiology of animal food and feeds (3) |
| Diagnosis of plant pathogens (4) | Animal food technology (1) |
| Molecular markers for genetic analysis and plant breeding (5) | Control of animal parasite (1) |

| | |
|---|---|
| General (core) molecular biology (4) | Animal reproduction systems (2) |
| (PCR recombinant DNA, transformation) | Dairy production (2) |
| Plant tissue culture for plant improvement (3) | |
| Soil microbiology (2) | |
| Genetics of bacterial pathogens (2) | |
| Biodiversity and conservation of plant genetic resources (2) | |
| Integrated management (ICM/IPM) (1) | |
| Genetic engineering in forest trees (2) | |

**PRIORITY 3**

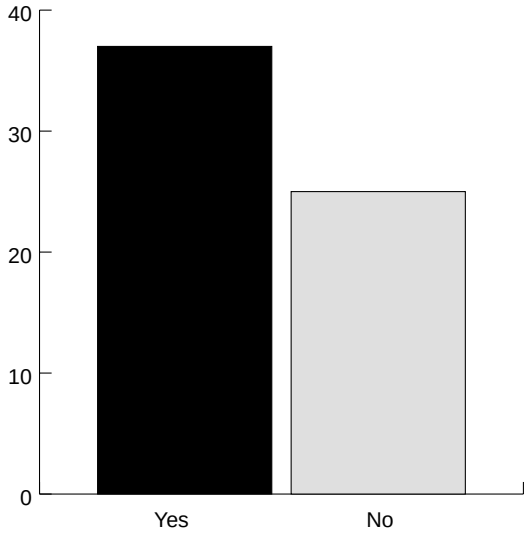
| **Plant Topics** | **Animal Topics** |
|---|---|
| Diagnosis of plant pathogens (6) | Animal reproduction (3) |
| Development of pest resistance in plants (4) | Animal food/feed biochemistry (2) |
| Use of molecular markers for genetic analysis and breeding (3) | Dairy processing (2) |
| Crop improvement (3) | Animal husbandry in Tropics (1) |
| Crop production (2) | Vaccine production (1) |
| Tissue culture for plant improvement (2) | Other |
| Genetic engineering (forest trees) (1) | Core technologies in molecular biology |
| Other | |

| **PRIORITY 1** | **PRIORITY 2** | **PRIORITY 3** |
|---|---|---|
| **Animal nutrition** | **Animal food products** | **Animal Reproduction** |
| Diagnostics | Integrated Crop Management (IPM or ICM) | Breeding (aided by molecular tools) |
| Plant biotechnology | Soil biotechnology | |
| Genetic engineering | Food microbiology | Biochemistry |
| Animal genetics and reproduction | Feed technology | Microbial biotechnology |
| New molecular biology techniques of relevance to quarantine services | Detection of plant diseases using molecular genetics | Screening of GMO's and handling methods of transgenic plants |
| Quick and accurate identification of plant pathogens | Prevention of plant diseases | Serology |
| Recombinant DNA technology | Bacterial genetics | PCR technology |
| DNA master/marker | Gene mapping | Genetic transformation |
| Molecular markers | Gene cloning and analysis | Plant transformation |
| RAPDs in genetic analysis and tree breeding | Molecular biology of cambial development | Modification of cambium |
| Cloning | DNA manipulation | Blotting and hybridisation |
| Micropropagation/ Tissue Culture | Pathogen identification using biochemical/ molecular tools | Molecular characterisation of germplasm |
| Applications of molecular biology in the dairy industry: animal improvement, disease identification and protection | Dairy production | Dairy processing |
| Biofertilisers | Biopesticides | Biocontrol of pests and diseases |
| Vaccine production | Control of parasites of animals | Animal husbandry in tropical conditions |
| Role of nutrition in determining reproductive success | New estrous synchronisation protocol | New techniques for semen evaluation and storage |
| Transformation | Molecular markers | |

| PRIORITY 1 | PRIORITY 2 | PRIORITY 3 |
|---|---|---|
| **Animal nutrition** | **Animal food products** | **Animal Reproduction** |
| Molecular disease diagnosis | Micropropagation of clean sugarcane/ potato varieties by tissue culture | Sugarcane improvement-molecular markers and genetic transformation, genetic transformation of potato |
| Crop breeding | Biodiversity and Plant Genetic Resources | Research on pathogens and population genetics |
| Recombinant bacteria | Recombinant plants | Recombinant animal cells |
| Pathogen detection and disease diagnosis with molecular tools | Biological controls of plant diseases | Transgenic plants for disease resistance |
| Diagnosis and detection of bacterial plant pathology by molecular technique | Identification of bacterial plant pathology by molecular technique | Diversity of bacterial plant pathology in Thailand |
| Production of disease tolerant plants | DNA finger print for the plant species identification | Plant improvement using biotechnology techniques |
| Embryo transfer & superovulation | In vitro fertilisation | Cloning |
| Genetic transformation | Gene mapping including DNA finger printing | Cloning—including tissue culture |
| Crop improvement | Genetic resources conservation | Crop production |
| Plant tissue culture | Soil microbiology | Plant improvement through biotechnology |
| Bioremediation | | |
| Detection of plant virus and mycoplasma like viruses | Bacterial molecular genetics application | |
| Use of tissue culture techniques in rice, potato, citrus and vegetable improvement | Micropropagation of potato and citrus | DNA recombinant vaccine development against footrot in sheep and goats |
| Izoenzyme method to distinguish the genetic diversity of some forest tree species (including their hybrids) | Transgenics in some valuable species of forest tree | Using tissue culture method to produce a mass propagation of forest tree species |
| Molecular marker technology | Plant tissue culture—protoplant systems | Plant disease resistance genes |
| Producing antiserum for plant pathogens | New approach in screening resistant varieties of crops to pests | Characterisation and diagnosis of plant diseases and related subjects of agriculture |
| Molecular Virology | Plant Transformation | Gene Expression |
| Molecular biology | Dairy production | Dairy processing |
| Microbial and plant genetics | Tagging for disease resistant gene | Risk assessment on GMOs |
| Genetic engineering of pathogen antagonist for biocontrol of diseases | Genetic engineering techniques (e.g. protoplasm fusion) for pests (disease and insect) resistance in plants | Production of monoclonal antibodies for detection and diagnosis of viral and bacterial plant pathogens |
| Genetic engineering of pathogen antagonist for biocontrol of diseases | Genetic engineering techniques (e.g. protoplasm fusion) for pests (disease and insect) resistance in plants | Production of monoclonal antibodies for detection and diagnosis of viral and bacterial plant pathogens |
| Development of transgenic Bt-cotton | Genetic transformation of CP genes for resistance to CMV and THV in Tobacco | Development of molecular markers to distinguish tobacco and fibre crop germplasms collection |
| Reproductive biotechnology | Biogermentation of feedstuffs | Molecular techniques for marker assisted breeding |
| Reproductive biotechnology | Biofermentation of feedstuffs | Molecular technique in marker assisted selection |

| PRIORITY 1 | PRIORITY 2 | PRIORITY 3 |
|---|---|---|
| **Animal nutrition** | **Animal food products** | **Animal Reproduction** |
| Application of Biotechnology in developing varieties of crops resistant to Fungal diseases | Biotechnological approaches in controlling viral diseases | Use of Biotechnological methods for the control of Bacterial and Nemic diseases |
| Plant Biotechnology and genetic engineering | Molecular Pathology | Medical Biotechnology |
| Transgenic plants resistant to potato and garlic virus diseases. | Variability of plant pathogenic bacteria and viruses. | Diagnosis kits for virus diseases |
| Plant molecular marker | Plant genetic engineering | Molecular Cloning |
| Improving plant resistance to diseases through genetic engineering | PCR | Understanding genetic pathways for colour expression in flower breeding |
| Gene tagging and pyramiding | Genetic transformation | DNA fingerprinting |
| Marker Assisted Selection in breeding | Molecular markers for disease and pest resistance. | Molecular markers for stress tolerance. |
| Molecular Characterisation of plant diseases | Molecular Marker and Plant Genes with resistance to plant diseases | Isolation and utilisation of plant genes with resistance to plant diseases |
| Genetic improvement of plant and animal resources. | Fermentation technology for the production of bio-substances. | The application of biotechnology product. |
| Plant biotechnology (tree, crop improvement) | Agriculture Biotechnology (Biofertiliser, enzyme production) | Animal Biotechnology (embryo, probiotic) |
| Employing RAPD method in biodiversity | Assessing the biosafety of transgenic plants for distribution | RILP technique for plant genome mapping |
| Enzyme Biotechnology | Biochemical Products | Environmental Biotechnology |
| Plant genetic engineering | Plant molecular biology | Plant tissue culture |
| Molecular marker | DNA fingerprinting | Gene Transformation |
| Molecular markers | Genetic transformation | In vitro technologies for?? breeding applications. |
| Microbiology | Hygiene and sanitation | Genetic engineering |
| Clonal improvement through tissue culture technique (Objective of SRRC) | | |

*Question 4. Has the contact with research and teaching Institutions in Australia or internationally resulted in further co-operation, exchanges or joint venture activities?*




A high number (60%) of organisations appeared to have established collaboration or collaborative research with other institutions.

*Details included:*

— IAEA—Vienna: research on dairy cattle reproduction and nutrition, CEC.
— Europe: research on animal nutrition, IFS—Sweden: research on Urea molasses blocks and dual purpose goat production
— DPI Queensland (Dr Peter Hofman); Curtin University of Technology (Prof. John James)
— Staff member now doing a master program at University of the Philippines (UPLB)
— The research institute is engaged in many research activities with domestic and international institutions eg 1 CSIRO on Genetic resistance against Fasciola gigantica in Javanese Thin Tailed sheep, 2 FAO on Genetic improvement of Javanese Fat-tailed sheep, 3 Uni Edinburgh on Antinutrients in tree legumes, 4 processing cassava as feed, 6 with PT Lembah Hijau Multifarm and Universitas Nasional Sebelas Maret on biostarter as supplement for ruminants and many others
— Exchange of information; to acquire advance equipment and materials needed
— Exchange of information; training of personnel
— The potential for joint ventures exists. One of the MC students is still working in my laboratory
— The staff recruited one co-participant from Indonesia to be her graduate student advisee.
— Contacts with Curtin University and Western Potatoes in conjunction with CIP on Seed Potatoes for Asia.
— Recently the NIUR in cooperation with Queensland University is carrying out a project for control of pasteurellosus in pigs and poultry in Vietnam.
— This resulted in further co-operation with the livestock agencies and Regional Field Units of the Philippine Department of Agriculture.
— In projects related to genetic transformation and genetic mapping of sugarcane/potato

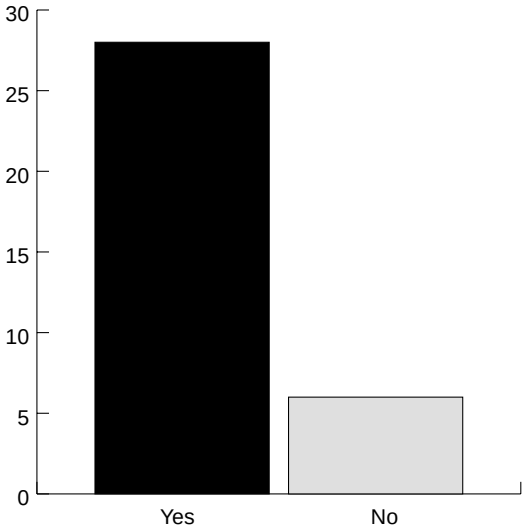
— Our Institute has established good relationship with ACIAR. We have submitted our project proposal on soybean research and development which will be supported by ACIAR in near future.
— Because in my institute need a new technique and knowledge in biotechnology for develop my research in the future
— The Plant Biotechnology research centre has been set up under the support from JICA. Furthermore, the graduate program in Plant Biotechnology (MR & PhD) has been also set up.
— Actually, I tried to set the co-project with CSIRO (Dr M D'occhio) on the improvement of superovulation in Thai Sevamp Buffalo. The project is not started yet, currently involves discussion and preparation.
— Through collaborative research eg ACIAR project; Projects funded by European Union
— International collaborative programs have been taken up by the Institute; so far no such collaboration exists with Australia. Funding for research program from an Australian source has also not happened so far.
— Ongoing collaboration on management of footrot in sheep and goats with ACIAR/ University of Sydney has continued, and a new phase of collaboration has just been agreed.
— Cooperation research with ACIAR, CSIRO (Australia), SAREC (Sweden); Oji paper Co Ltd (Japan)
— We have being carried out research on biological control of grass weeds (PN9402) funded by ACIAR. Assessment study of bacterial wilt of legume crops is associated with ICRISAT. Identification and exchange cultures with IMI (UK) and Queensland University (Australia)
— We have close collaboration with Professor Dale at Queensland University of Technology and developed an ACIAR-supported project on papaya for virus resistance.
— Dr Niphone and staff have a collaborative work with Dr Holloway on biotyping of bacterial wilt pathogen
— We have a number of research collaborations with Australia
— We are still looking for further cooperation
— Involved in pasture network in Asia. Participated in regional workshop on R&D elected issues
— Dr Chris Hayward, plant bacteriologist from University of Qld, stayed at CNPH as a consultant for 2 weeks in September 1996. It helped our lab in the start of molecular work on Ralstonia solanacearum involving our young staff.
— Now our institute has a cooperative research project titled 'Improved diagnosis and control of peanut stripe virus' with Queensland Agricultural Biotechnology Centre in Brisbane, which is funded by ACIAR and aims to develop a resistance of peanut to peanut stripe virus by genetic engineering.
— At the moment it is primarily with regard to exchange of ideas and contacts.
— Collaborating in Asia Rice Biotechnology Network. Rockerfeller Foundation's grantee for genetic transformation of rice. Rockerfeller Foundation career fellowships to three scientists. With: University of Birmingham UK, Texas A&M USA
— Our staff (Ms Inez Irene Atmosukarto) is pursuing PhD degree in animal molecular biology (genetic engineering) in the University of Adelaide. ACIAR Project on 'Genetic

and Immunological Characterisation of High Resistance to Internal Parasites in Indonesian sheep.'

— By this time, we tried an effort to pursue the collaboration of research on soil condition or product among our institute and the Australian University together with the Australian Company.

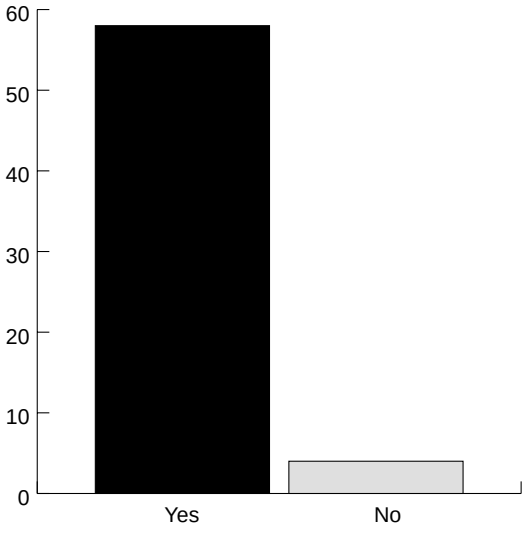
— Ongoing collaboration research on molecular genetics of pseudo??. New contacts with AVRDC and other scientists and potential collaboration on research.

*Question 5. Would it be valuable to have follow-up to the Master Classes in some form for the benefit of participants and the Crawford Fund?*



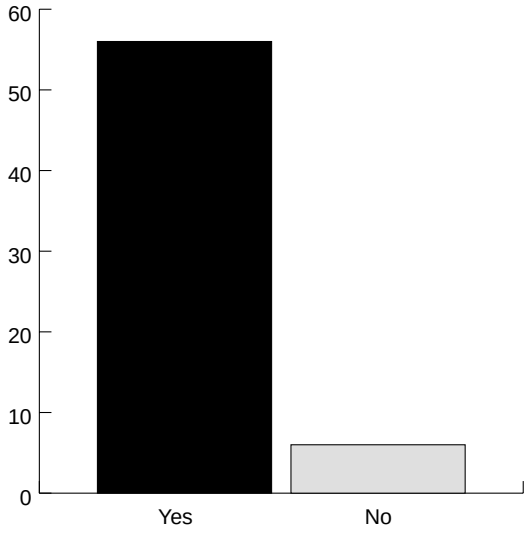

Only 60 of the 62 questionnaires returned responded to this question. Of those, 53 (88%) indicated follow-up would have benefited the participant. Most frequently mentioned responses were for refreshers, updates on technical developments, exchange of information via newsletter and for collaborative research projects.

*Question 6. Would you continue to nominate your staff to attend Master Classes in Biotechnology if the opportunity arose?*



Almost unanimously (93.5%) people indicated they would continue to nominate staff to attend the Master Classes.

*Question 7. Would you nominate your staff to attend similar Master Classes in other topics in agriculture? If so, which topics?*



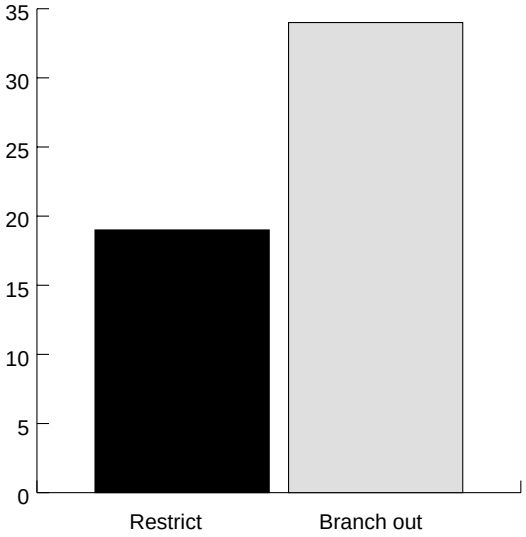

A high percentage (90%) would nominate staff to attend similar courses. A list of these courses are given below.

— Milk and milk products microbiology
— Integrated Pest (Crop) Management
— Postharvest Physiology of Tropical Fruit; Agribusiness
— Food microbiology or Food technology
— Pasture improvement and management; Environmental physiology; Post harvest technology
— New technologies in screening for diseases
— Any topic relevant to Crop Protection
— IPM
— Statistical analysis; Plant physiology
— Most covered in house
— If applicable to forestry
— Breeding/ Plant Genetics
— Dairy production—Animal health, Reproductive Physiology, Pasture and Forage; Dairy Technology and Engineering
— Biotechnology priorities
— Potato and vegetable breeding; Tissue culture (plant); Horticultural production
— Biotechnology in vaccine production; Biotechnology for control of parasites of domestic animals
— Animal Health is recommended for consideration. Application of bio-engineering in the production of vaccine.
— Oilseeds Research/ processing
— Integrated pest management; Sustainable broadacre cropping systems

— Genetic engineering; Use of molecular markers for breeding purposes; germplasm conservation in vitro
— Plant genetic resource; Biotechnology in crops breeding and plant pathology
— The basic or essential technique use in Molecular biology of plants
— Plant disease diagnosis using Nucleic Acid technology
— Technique of Molecular biology for detection, diagnosis, identification in bacterial plant pathology and technique use for study of diversity of bacterial plant pathology.
— Plant pathology; Integrated Pest management; Plant taxonomy.
— Reproductive immunology and vaccination; veterinary medicine; cattle, pig management in reproduction
— Biodiversity assessment; Production of novel products
— Biodiversity conservation and management
— Short courses in Forestry, Forest ecology, Minobiology, GIS/GPS/RS
— Any topic related to both plant pathology and insect pathology subjects.
— Biofertilisers—N fixation; Integrated management of pests—rearing techniques; Agroforestry—genetic mapping; Tissue culture techniques—RFLPs
— Identification of seed quality by X-ray; Identification of genetic diversity in forest tree species (including karyotype, DNA analyse, gene mapping)
— Plant Breeding and Genetics
— Production of antiserum/antibodies of filamentous fungi, bacteria and viruses; ELISA specialising training course; PCA and protein-based techniques training courses.
— Agricultural biotechnology—Plant transformation, Identification of plant genes, Risk assessment of transgenic plants,—Biocontrol of plant lists
— The technology of ET
— Microbial and plant genetics; Tagging for disease resistant gene; Risk assessment on GMOs
— Master classes in molecular biology ($\times$ 2)
— Molecular plant genetics, Molecular techniques related with plant disease
— Research management. Modelling and simulation of production system and feed budgeting
— We need special training on bacteriology, virology and seed pathology.
— Molecular Phylogenetics. Advanced Molecular Biology. For gene manipulation transformation.
— Please send other topics covered by Master Classes. We are interested in topics involving Vegetable Crops. Ex: Seed Technology, Quarantine Techniques, Diagnostic kits for disease detection.
— Identification of diseases using molecular techniques. Biological control of plant diseases.
— Fluorescent Insitu Hybridisation. Silt directed suntagenesis. Isolation of tissue specific promoter.
— Plant breeding. Biodiversity. Biopesticides.
— Isolation and utilisation of plant genes with resistance to plant diseases and insect pests.
— Biotechnology in horticulture. Animal conservation biotechnology.
— Microbial Genetic Engineering for agriculture and industrial aspect. Plant genetic improvement for agriculture and forestry.

— Gene cloning based on genome map, which contains construction of YAC/ BAC library. RILP, RAPD chromosome walking and function identification by transformation etc.
— We are mainly interested in improve quality or production of plant's produce by enzyme manipulation or molecular biology methods.
— Plant genetic engineering. Plant molecular biology.
— A master class on Microbial and Plant Molecular Genetics at Australia in 1997.
— Molecular markers for genoplasm conservation and breeding applications. Genetic transformation.
— Dairy Science, Animal Science, Plant Science, Microbiology, Biotechnology.
— Breeding

*Question 8. Do you believe that the Crawford Fund should restrict itself to Master Classes dealing with biotechnology and its applications to agriculture or would you wish to see it branching out into broader areas of agriculture?*




Of the 53 usable responses, 19 (36%) indicated the Crawford Fund should restrict itself to biotechnology and its applications to agriculture, 34 (64%) indicated the Crawford Fund should branch out.

Some respondents indicated that biotechnology skills were required in the Asia Pacific region and that master courses met these needs.

*Suggested areas the Master Classes should branch out to included:*

— Master classes would be better expanding to other areas such as plant tissue culture, plant breeding.
— I would prefer to see it branch into more areas that are not covered by other teaching/ training institutions.
— Broader areas are justified: there is much more to agriculture than biotech; biotech needs to be integrated.
— Plant as a bioreactor for producing animal macromolecules of medical importance.
— I myself concern on biotechnology, but anyway information technology and computerised program on animal production should be considered.

— Socioeconomics; Research methodology
— Crawford Fund should have open Master Class course in forest tree improvement field such as: Technologies for identification of karyotype, izoenzyme and gene mapping of forest tree species; Identification seed quality by X-ray, transgenics in forest tree species
— We wish to see the Crawford Fund branch in the field of Agriculture, so that it can be easily combine together with biotechnology and agriculture in general.
— I wish to see it branching out into broader areas of agriculture
— Branching out to commercialisation aspects.
— It should be branched out into broader areas of Agriculture
— For the present we still need more exposure to the tools of biotechnology, to ensure a critical mass of trained personnel. The workshops should concentrate on microorganisms, plants or animals.
— We would like to see the Crawford Fund branching out into broader areas of agriculture, as technology of production, management of natural resources and germplasm management.
— It would be much more beneficial if the Crawford Fund could be branching out into broader area, such as conservation biotechnology (including animal and plant genetic resources).
— I wish to see Master Class dealing with other areas such as physiology, post harvest technology, biodiversity etc.

*Question 9. Do you have any further comments to make on the perceived benefits or otherwise of your staff attending Crawford Fund Master Classes?*

Comments made in response to question 9 were varied. Key themes include:

- the desire for continued funding for research programs by the Crawford Fund.
- the perception that the master classes were a scientific bridge between Australia and other countries
- the desire to be more involved in nomination of participants
- the suggestion that informal networking would be valuable
- a number of respondents took the opportunity to note the benefits of the master class to participants

*Verbatim comments*

— We suggest that the Crawford Fund could provide funds for research programs in collaboration with our institution, in which the participants should be involved in.
— These classes are highly beneficial to students that come from a background with a less pronounced science culture than prevails in Australia
— The Crawford Fund should give more opportunities to our staff to attend Crawford Fund Master Classes.
— It should be followed by another activity
— The same person should be allowed to attend under a similar area of topics which is most related to his or her job so that his or her expertise can be developed. Continue to communicate and be informed of the latest development even though after attending any master class under Crawford Fund.
— The program should be publicised to get greater participation

- She found the course very useful in her work on pepper genetic manipulation where we have a program to incorporate the anti-sense gene into the pepper berry. Subsequently, a person who attended the same course found it useful for his work on developing a method for detecting the citrus greening virus using the DNA probe.
- These are important means of exposing practising agricultural researchers to specialist issues.
- The experience in 94 & 96 of research fellows and another post-graduate was very positive.
- I hope they will be continued and that I will remain on a mailing list announcing vacancies in upcoming Master Classes.
- We were made aware that we need to update ourselves in terms of R&D.
- We wish to see the Crawford Fund Master Classes continue in coming time to be a scientific bridge between Australia and Vietnam.
- Except for recommending the branching out into other areas other than biotechnology, the Agency would like to commend ACIAR for the excellent conduct of the course. The Agency hopes that the reported excellence will be perpetuated.
- The spread of expertise was, not unexpectedly, very broad and some people had difficulties. I might have been better to limit the scope (I realise that this is always a factor of cost).
- The master classes are very useful and relevant to our research program in biotechnology.
- The classes have significantly improved knowledge and skill of our staff.
- Applications of plant to produce animal bioactive molecules, such as human hemoglobin, immunoglobulin etc has high potential applicable in medical sciences. Therefore, it would be very useful if ACIAR could arrange this type of training course.
- At present Dr Wongkaen has been appointed the coordinator in Agricultural Biotechnology Project in which Khon Kaen University is a consortium member. The project is sponsored by the Ministry of University Affairs having Kasetsant University as the core member and 6 other national universities as members. The project plans to have linkages with as many leading international universities as possible. Monash University has been counted. Crawford Fund could play the key role in establishing the link.
- I hope that the cooperation with Crawford Fund Master classes for information and a new knowledge and new techniques of biotechnology to develop our research.
- If possible, I'd like to have direct contact to the Crawford Fund Master Classes in terms of nomination of the participant. Because if it passes to other channel, you will not get the proper participants who are really fit to the course. This could be blamed to the Thai side. Moreover, we are not in Bangkok, so the information usually be so late for us we sometimes even don't have time to prepare the document.
- I myself involve in training course of buffalo reproduction and I would like to suggest for a co-operation between Thai-Australian researchers to provide the lecture re the topic as in the course. Secondly, our young staff not only the lecturers but also scientists and technicians need more information and techniques to improve our research. Finally, visiting professor or researchers will be useful.
- An informal networking activity may have to be set up for those who participated in the classes. The impact of the training/ classes may be felt 3now. It will add to the prestige of the Crawford Fund if some of the grantees were able to attain some breakthrough in their respective fields.

— Yes, I do have some comment in the question number 4. It seems to be too early to have this question. In my own view it needs longer period of time to do establish contact with other scientists/ researchers. Other limiting factor concerned with this issue is some of laboratory tools for running the work are so expensive and are really hard to get funding support from the government, although knowledge she got from that participation is excellent.
— With knowledge (including theory and practice) getting back from Master Class course, our staff has achieved results in propagation by tissue culture from some main planting tree species such as: Acacia hybrid, Eucalypts, Rattan, Bamboo etc, especially we have exchanged some clones of Acacia hybrid propagated by tissue culture with FRIM of Malaysia.
— The courses are particularly useful to new postgraduate students or staff needing training in broad aspects of molecular biotechnology. Further and more specific training can be provided by staff within the department.
— Crawford Fund Master Classes should be more based on the needs of an agricultural practices and participants would be able to do hands-on techniques in the laboratories to gain their knowledge and skill.
— The concept of jointly-organised by the Australian team and local scientists for the master classes is very well done. However, the frequency of having the MS is quite important. The more the better. This is the good way to stimulate scientists to do research by applying new techniques directly to their research problems. Some of ACIAR supported projects can be initiated by those who attended the MS. Another word, the course can be arranged as a project design workshop as a follow up.
— This Crawford fund master class is one of the best project which offered an opportunity for our staff and developing countries to learn, update and gain scientific benefit. Beside to expand the collaboration among scientists from over the world and know each other the project will directly benefit to the former as well. I would like to congratulated for the highly successful of this project.
— The RITFC would like to receive any further publications or newsletter issued by the Crawford Fund in areas of biotechnology.
— Adoption of improved techniques in resource management to local needs and conditions.
— Dr Kazi Alam who has attended courses on Microbial and plant genetics, in Nov 94 has left for Australia as an immigrant. So we need training for other staff members.
— Unfortunately although Dr Krishna attended the masters class on plant gene technology (Nov/Dec 95) in Canberra, she left to a private R&D company quite soon after. As she was a post doc on my program, it was indeed a great loss. In order to avoid such events hereafter, it is recommended that only postgrad students, technical staff and academic personnel (permanents) be selected for such programs. The benefits will then be more likely to spill over to the research and teaching programs, as a whole, on a more regular and permanent basis.
— Dr Lopes training with a consequent consultancy from Dr Hayward were very strategic for the implementation of the biotechnology lab at CNPH, especially for positively influencing our young staff.
— The classes are very useful and beneficial, and should be continued in the future.
— All the financial obligations of the participants for developing countries during training should be discharged by the Crawford Fund/ organisers. The participants should be

informed in advance about the labs and areas to be visited/ discussed during the training course.

— Dr Mao will do further training in molecular genetics through research work in United States this summer. He will spread the knowledge obtained in the class to his colleagues as well as graduate students as he did before, for he is a part-time associate professor in the Graduate School of Chinese Academy of Agricultural Sciences.
— Looking forward to receiving any opportunity for our staff to pursue higher degree.
— It is beneficial in the way that the staff can learn some new methodology or theory that are not available in our country and perhaps can get future cooperation in research.
— A person who chooses only lecture may not understand well if he doesn't take the lab. So, the lecture should be clearer or more details.
— The Master Class is an excellent and cost-effective mechanism for ? resource development with field of biotechnology.
— Note: Now, our office has not prepared or set up the laboratory of biotechnology yet.

### A1.4.3. Findings: Course Provider Questionnaire (Questions 1 to 14)

*Question 1. Why did you accept the invitation to teach a Master Class?*

Most people accepted the invitation when asked by supervisors or organisations, others were motivated by interest in training foreign scientists or by a desire to improve their departments profile. Others indicated personal benefits of enhancing their own overseas networks.

*Question 2. Please indicate your views on the course design (ie length, internal structure, balance of theory/practice etc)*

An overwhelming number of respondents felt that the course design was either good or excellent, particularly the balance between theory and practical work.

*Question 3. Please indicate your views on the course content relevant to the needs of participants*

Some criticism was levelled at the mismatch between course content and the existing students skill levels. Some respondents indicated that the content may have been too advanced for participants.

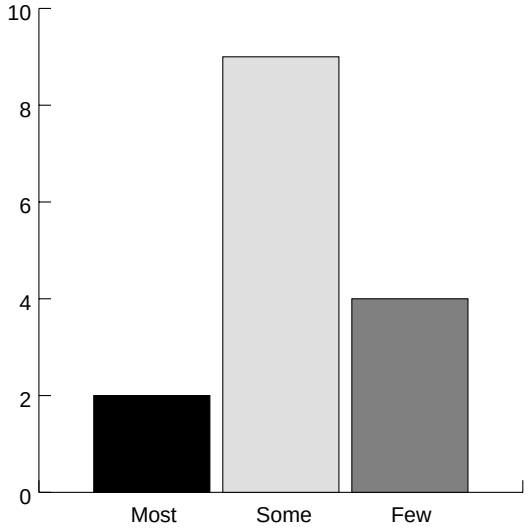
*Question 4. Please indicate your views on the selection of candidates (eg prior experience, English language comprehension, ability to apply learning back in home country)*

Most respondents agreed that selection of candidates was satisfactory, however, a small number of respondents expressed the view that students were training in areas they were not working in and hence might not apply the learning, or were in an administrative or managerial role in their home country.

*Question 5. Please indicate how thorough and useful your prior background briefing was on participants and their needs and expectations*

A majority of respondents indicated that background briefing was sufficient to very good. A few indicated the briefing could have been more thorough, however it was noted that this was difficult with the variety in the group.

*Question 6. Please indicate your opinion of how likely it is that students would apply the knowledge back in their home country*




Of the 15 respondents to this question, a high proportion (60%) indicated that some students but not others would apply the learning. 27% indicated that few students would apply the knowledge. Two people indicated most students would apply the knowledge.

*Question 7. What are your views on the relative value of a basic core course on the relevant core technologies versus a specific master class on a specialised topic?*

Responses indicated that because participants came from such diverse backgrounds basic core courses were more appropriate, although there is also the possibility of specially selecting participants for more in-depth courses specific to their needs.

*Question 8. What are the advantages of and constraints to holding Master Classes in Australia versus in a Developing Country?*

Several people 10/15 (67%) discussed the difficulty in finding equipment, technology and expertise in developing countries that are readily available in Australia. The most commonly mentioned advantage of holding the classes in a developing country was that this would provide direct access to conditions and situations that participants themselves work in and may more appropriately address their needs. Two people commented on the exposure of participants to other cultures and industries, as well as practising scientists.

*Question 9. One of the challenges of the learning process is supporting students to implement their learning on return. What possible cost-effective ways of follow up can you suggest?*

Suggested methods of follow up are listed below.

— Email—2
— Use of www/internet—2
— Follow up visit—3
— Progress reports on how they are implementing their acquired skills—2
— Video linkage as a group—linked to course lecturers
— Contact of their Institute to see how the participant has used the experience
— Library Services
— Ongoing projects supervised from Australia via fax or email
— Refresher courses in their own country
— Provision of a list of experts (eg course lecturers) to contact.
— Distance education tutorials/ exams

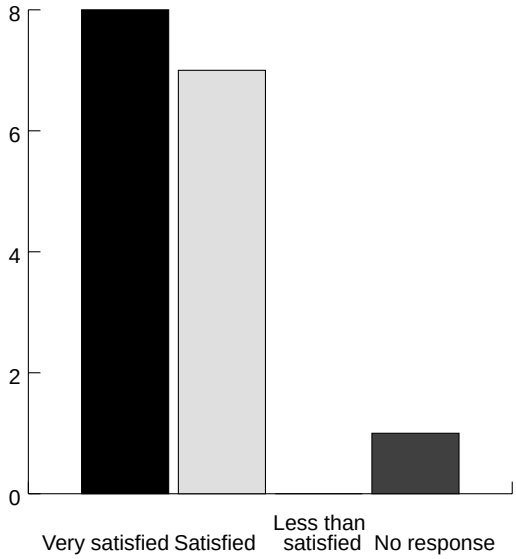
*Question 10. What ongoing contact do you have (if any) with past students?*

The majority of respondents had little to no contact with participants, only one course provider has ongoing contact with several participants

*Question 11. What likely ways are there, from your perspective, to build contacts for subsequent collaboration?*

- Suggestions for building collaboration included:
- Post-graduate research collaboration or specific customised courses
- Networking amongst previous participants
- E-mail, correspondence
- Developing ongoing research projects
- E-mail contact with the teaching staff and encouragement to make contact
- More communication on concrete research plans by the participants
- Encourage students while in Australia to make contacts with seniors in the labs where they see possible techniques/ ideas of applied relevance back home
- Refresher courses
- Exchange of students
- Continued personal contact

*Question 12. What was the level of your satisfaction with the teaching experience? Please explain*




All of the participants were either satisfied or very satisfied. There was only one non response, however they provided a positive comment.

*Comments included:*

— Most enjoyable because of participant response.
— Eagerness and willingness to learn displayed by participants was most rewarding and satisfying.
— Some of the information I gave (Plant Biotechnology) may not have been relevant. It is also difficult to teach this topic without the students having a good background in biochemistry and botany.
— It's a mixture. Some things go well and some students get a lot out of the exposure. Those held at Monash were superior to the one at AVRDC Taiwan.
— There was an excellent interaction between staff and students
— Very useful to feel that knowledge/ methodology is being transported to regions where it will be used to solve practical problems in the longer term.

*Question 13. Following your involvement in a Master Class do you think that some form of de-briefing for you would have been valuable?*

Most respondents (53%) believed some form of debriefing would have been valuable, with 33% indicating no debriefing was necessary.

*Question 14. Do you have any views on the strategic benefits of Crawford Fund Master Classes to Australia/Asia and the evidence of their impact to-date?*

*Comments included:*

— They should be valuable in a range of areas. Uncertain whether value is being gained.
— Some instance of networking. Plan to use several contacts in forthcoming visit to SE Asia.

- We are currently involved in a collaborative project with a participant of the course.
- Strategic benefits very good for Australia/ Asia. Impact is increased research networks, increased knowledge. New information relevant to Australian problems.
- I think tremendous good will is generated for Australia and this is to an influential group of mid-career scientists and the people in their respective institutions.
- I think they have been valuable, but could be improved. How to do that needs to be 'workshopped'. There has been a good start, now lets improve on it. Very important to Australia/ Asia. There are many tangible and some less tangible benefits of Master Classes. It is important now to optimise Master Classes and continue them as part of Australia's technical aid program. The friendships and networking are important for people who are often remote from technical support. I know that many keep in touch as more and more become equipped with email. For some participants application of core technologies is in the distant future. When the applications are possible they are more likely to be in the context of regional diagnostic labs than genetically engineered disease resistant plants (for example). In such classes the Master Classes serve as a catalyst for long term change.
- Though I personally have not had interactive research follow up. I see this as a real possibility with future classes. It is a matter of chance re specific interests of particular attendees.
- The former students will be involved in the bacterial wilt ecotyping project which should provide information on the BW pathogen situation in Australia and SE Asia. In the long term this will help with developing BW-resistant crop varieties in the region.
- I have not seen any significant benefit. Specific on the job training is always better.
- All of the above; also cultural exchange and attraction of overseas, fee-paying students.
- The benefits to both Australia and Asia are enormous. Asian countries are craving for knowledge on advanced technologies especially in the area of food production. Australia is in a unique position with such knowledge and helping Asian countries through foundations such as Crawford Fund. This is leading to better understanding and close co-operation between these two regions.

## ANNEX 2

## ADDITIONAL FUNDING FOR MASTER CLASSES 1995 TO 1997

| | |
|---|---|
| Victorian Dairy Foundation (La Trobe 1995) | $5000 |
| DIST (Malaysia 1997) | $15000 |
| DEST (Malaysia 1997) | $17 500 |
| Australian Academy of Science (Malaysia 1997) | $3500 |
| Genetics Australia (Beef Cattle Reproduction 1995) | $1000 |

The contributions by UNIDO and the Thai Centre for Biotechnology for the 1995 Bangkok class exceeded that of the Crawford Fund but were not disclosed. Also the contribution of AVRDC to the class in Taiwan in 1996 was not disclosed but was the total cost of the class less the $25, 000 provided by the Crawford Fund. ACIAR contributed $100, 000 to the cost of the 1997 IRRI class while there was no actual financial contribution by the Crawford Fund to this class.

The following list of collaborating organisations have also been involved in supporting master classes.(F) those that contributed financially.

- Federation of Asian Scientific Academies and Societies
- Australian Academy of Science (F)
- International Service for National Agricultural Research
- CRC for Plant Science (F)
- Tropical Beef Centre (F)
- UNIDO (F)
- Thai National Centre for Biotechnology (F)
- AVRDC (F)
- Universiti Putra Malaysia (F)

# ANNEX 3

## TERMS OF REFERENCE FOR THE EVALUATION OF THE MASTER CLASSES IN BIOTECHNOLOGY

a) To assess the appropriateness and applicability of the master classes in biotechnology to the partner countries' needs in the past, at present and in the future; and to assess the impact and relevance of the master classes in biotechnology to the countries involved.

b) To undertake a tracer study on present whereabouts and roles of trainees from the classes in the assessment of the impact of the training on their personal development and their contribution to socio-economic development in their respective countries.

c) To assess the benefits and disbenefits (if any) to Australia resulting from Australian scientists conducting master classes in biotechnology. For example, has Australia proceeded too quickly in building up capacity in biotechnology in the Asia-Pacific region and has this as a consequence compromised Australia's ability to export biotechnology-based goods and services?

d) To assess progress towards achievement of each specific objective of the master classes in biotechnology.

e) To assess the scientific methodology and rigour shown in the implementation of the master classes in biotechnology.

f) To comment on the adequacy of reporting from the master classes in biotechnology.

g) To comment on the administration of the master classes in biotechnology, by ACIAR, the Crawford Fund and by the Australian and overseas institutions involved.

h) To indicate whether the master classes in biotechnology outputs represent a reasonable return for the funds invested.

i) To advise ACIAR and the Crawford Fund on the appropriateness of continued funding of master classes in biotechnology.

j)To advise ACIAR and the Crawford Fund on ways to improve the current structure of master classes to cater for a changing trainee catchment and as the objectives of the master classes broaden to include communications technology and other technologies.

k) To advise ACIAR on how spill-over benefits of the master classes in biotechnology might be maximised, and what if any follow up activities and support are desirable to ensure long-term benefits from the master classes in biotechnology, including linkages to other initiatives.

# ANNEX 4

# MEMBERSHIP OF THE EVALUATION COMMITTEE

**Dr James R. McWilliam**
**Chairman**
Agricultural Research Consultant
52 Buderim Avenue
Mooloolaba, Qld.

**Dr Ratna Sdoodee**
Faculty of Natural Resources
Prince of Songkla University
Thailand.

**Mr Larry Marlow**
Managing Director
Marlow Hampshire Pty Ltd
Sydney, NSW.

**Resource Persons**

**Dr Godfrey Lubulwa**
ACIAR
Canberra, ACT
**Ms Susan McMeniman**
ACIAR
Canberra, ACT

# ANNEX 5

## PERSONS INTERVIEWED

The following stakeholders and others who have been associated in some way with the Crawford Fund and Master Class Program were interviewed. The interviews covered mostly strategic issues relating to the future development of the program.

**Dr Rudy Appels**
Division of Plant Industry
CSIRO, Canberra, ACT

**Dr Ian Bevege**
ACIAR
Canberra, ACT

**Assoc. Professor Graeme Blair**
University of New England
Armidale, NSW

**Dr Denis Blight**
Director, I.D.P.
Canberra, ACT

**Dr Alex Buchanan**
Executive Director
Crawford Fund for International Agricultural Research
Melbourne, VIC

**Dr R Clements**
Director
ACIAR
Canberra, ACT

**Professor Adrian Gibbs**
ANU
Canberra, ACT

**Dr Anil Grover**
Visiting Fellow (CSIRO)
University of Delhi
India

**Mr J Ingram**
Griffith
Canberra, ACT

**Assoc. Professor C Hayward**
Dept. of Microbiology
University of Queensland, Brisbane Qld

**Professor Bruce Holloway**
Coordinator, Master Classes in Biotechnology in Agriculture
Crawford Fund, Melbourne, VIC

**Professor B Norton**
Department of Agriculture
University of Queensland, Brisbane, Qld.

**Dr Jim Peacock**
Chief
Division of Plant Industry CSIRO
Canberra, ACT

**Dr Gabrielle Persley**
Australian Trade Commission
Brisbane, QLD

**Professor Ralph Slatyer**
ANU
Canberra, ACT

**Ms Helen Ware**
AusAID
Canberra, ACT

**ANNEX 6 MASTER CLASS PARTICIPANT QUESTIONNAIRE**

**ANNEX 7 COURSE PROVIDER QUESTIONNAIRE**

**ANNEX 8 INSTITUTIONAL QUESTIONNAIRE**