

Research, development and commercialisation

Introduction

- 5.1 The gene technology and its products that are available in Australia are sourced from both Australian and overseas research. This chapter examines Australia's research performance in this field, the commercialisation of its gene technology research, and Australians' access to overseas gene technology.

Research and development in agricultural gene technology

Research in Australia

- 5.2 It is not known precisely how much agricultural gene technology research is carried out in Australia, although expenditure in this area is estimated to be around \$100 million a year. According to Agriculture, Fisheries and Forestry Australia (AFFA), most of Australia's gene technology research is performed by the public sector. In relation to Commonwealth funding, for example, CSIRO spent \$40 million on gene technology research in 1998. In mid 1997, funding from nine rural research and development corporations (RDCs) was supporting 88 gene technology projects to the value of about \$12 million per annum. RDC funds are derived from both industry levies and AFFA and, according to the Rural R&D Chairs Committee, it is not uncommon for individual RDCs to allocate about 20 per cent of their

budgets to gene technology.¹ CRCs also perform gene technology research with a mix of public and private sector funding.

- 5.3 By contrast, private sector expenditure by about 20 small companies probably amounted to \$8-15 million per year.² Subsidiaries of multinational firms, such as Monsanto and AgrEvo, also conduct work in Australia. A survey commissioned by the NFF in 1998 found that, by comparison with other countries' performance in agricultural biotechnology, 'Australia does ... appear to lag in industry funded research which is focussed on commercial outcomes.'³
- 5.4 In 1999 there were 86 sites registered with GMAC to conduct contained genetic manipulation research in Australia. These sites were in universities, medical facilities, companies, CSIRO and state departments of agriculture,⁴ and included laboratories devoted to medical as well as agricultural research.
- 5.5 Gene technology research funded by RDCs includes pasture improvement; animal feeds; animal breeding, health and nutrition; food processing; and enhanced product characteristics.⁵ CSIRO is using gene technology with crops and fruits (peas, potatoes, sugar, grapes, barley and wheat), to improve eucalypts for wood and paper production, to control animal disease and to improve productivity (fish and seafood, sheep, pigs, cattle and poultry).⁶

Funding for research

- 5.6 Public funding for agricultural gene technology research is provided by both state and the Commonwealth governments. The Commonwealth government contributes funds to CSIRO, the rural RDCs and CRCs.
- 5.7 Several submissions to the inquiry called for continued strong government support for rural R&D, including for biotechnology. For example, the Grains Council of Australia (GCA) pointed out that, in the absence of government funding, there would be under investment in R&D, and large external benefits to the community and opportunities for pursuing national interest objectives would be lost. It drew attention to a 1991 study by the GRDC of the benefits of GRDC research. This study indicated that

1 Agriculture, Fisheries and Forestry Australia, Submission no. 77, p. 4; Rural R&D Chairs Committee, Submission no. 49, p. 2.

2 Agriculture, Fisheries and Forestry Australia, Submission no. 77, p. 4.

3 National Farmers' Federation, Submission no. 36, p. 7.

4 Agriculture, Fisheries and Forestry Australia, Submission no. 77, p. 4.

5 Agriculture, Fisheries and Forestry Australia, Submission no. 77, p. 4.

6 CSIRO, 'Gene technology in Australia', <http://www.csiro.au/pubgenesite/research/index.htm>, accessed 28 April 2000.

returns on individual projects varied from 34 to 561 per cent; the overall benefit:cost ratio was 19:1.⁷

- 5.8 The case for government support is particularly strong where an industry is characterised by many small firms, as in the grains industry, and the cost of the research is high, as it is for biotechnology. Indeed, the GCA argued in its 1999 submission to this inquiry that the Commonwealth government should increase its contribution beyond the present 0.5 per cent of the gross value of production.⁸ However, the GRDC is currently very well endowed financially and expects increasing income from royalties in coming years. Other RDCs are less well off.⁹
- 5.9 A further argument for government funding is that it enables the development of gene technologies that give Australia bargaining power to access technologies held by other parties. For this reason, the CRC for Tropical Plant Pathology called for substantial funding for gene technology research in public institutions, preferably in partnership with Australian or overseas private interests.¹⁰
- 5.10 A case for government support for research funding was also put to the committee in relation to so called 'minor' crops that are important to Australian farmers but not grown widely around the world. The fear here is that overseas owners of gene technologies will be uninterested in making the technologies available for use with these crops.¹¹ As many Australian crops are minor crops, 'this makes Australia vulnerable to being shut out from access to this technology for many of its crops'.¹² The same may prove true for peripheral livestock breeds. To circumvent this problem for crops, 'it is important to maintain our own germplasm and research capacity and capability to insert critical genes into varieties of importance to Australian agriculture'.¹³
- 5.11 For minor crops, Avcare suggested that:

It is possible in the future, that appropriate minor use programs such as those being developed for agricultural chemicals will need to be determined for applications of gene technology that are not currently supported by global priorities.¹⁴

7 Grains Council of Australia, Submission no. 65, pp. 6-7.

8 Grains Council of Australia, Submission no. 65, pp. 7-8.

9 P Hemphill, 'Grains funds boom', *Weekly Times (Vic)*, 19 April 2000, pp. 1-2.

10 Cooperative Research Centre for Tropical Plant Pathology, Submission no. 21, p. 3.

11 National Farmers' Federation, Submission no. 36, p. 10.

12 Western Australian government, Submission no. 48, p. 2.

13 CSIRO, Submission no. 56, p. 5.

14 Avcare, Submission no. 61, p. 6.

In some fields, work is unlikely to be carried out unless it is done in Australia.¹⁵ The NSW Farmers' Association suggested that:

One can ... conclude from a study of market share that public breeding programmes will be obligatory for smaller crop species, such as Durum wheat or for specialised varieties to meet particularly difficult conditions. The tonnages grown may not be adequate to support a fully commercial breeding program which will be particularly true in the case of a new crop.¹⁶

5.12 The NFF recommended that the government should:

... encourage opportunities in Australia for commercialisation of biotechnology traits that may be of little interest to multi national companies but have significant market value both domestically and possibly to other countries. Such investment will help to ensure Australian agriculture has access to biotechnology products.¹⁷

5.13 From the points discussed in the preceding paragraphs, it is clear that gene technology is significant nationally but expensive. For these reasons, the committee concludes that it deserves government funding. It is important that a coordinated strategic approach is taken here, as the Western Australian government suggested.¹⁸ Identifying emerging strengths, setting priorities and pursuing a more coordinated research focus should be goals in such a strategy.¹⁹ Aquaculture, for example, was brought to the committee's attention as an 'important emerging primary industry sector based on small to medium sized businesses', the benefits from which 'are not widely recognised'.²⁰ The committee believes that support for such industries will promote innovation of the kind needed for Australia to maintain its international competitiveness.

15 Cooperative Research Centre for Premium Quality Wool, Submission no. 52, pp. 1-2.

16 NSW Farmers' Association, Submission no. 38, p. 6.

17 National Farmers' Federation, Submission no. 36, p. 10.

18 Western Australian government, Submission no. 48, p. 2.

19 Innovation Summit, Resource and Infrastructure Consolidation and Cooperation Working Group, Executive summary, Melbourne, 9-11 February 2000, pp. 7-8.

20 Victorian government, Submission no. 67, p. 1.

Recommendation 10

- 5.14 **The committee recommends that Agriculture, Fisheries and Forestry Australia develop a strategy for Commonwealth funding to facilitate and encourage the innovative use of gene technology in the development of commercially viable, emerging industries in agriculture, fisheries and forestry.**

This strategy should be drawn up in consultation with state and territory agriculture departments and the private sector.

- 5.15 This strategy will be developed in the context of a much larger role for the private sector than has been the case up to now. The committee was told that even greater commercial involvement can be expected in the future,²¹ in what is a world wide trend occasioned by the lack of public resources.²² The Western Australian State Agricultural Biotechnology Centre predicted that 'plant breeding of cereals [in Australia] will be 100% privatised within 5-7 years'.²³
- 5.16 Accepting that private sector involvement in gene technology R&D will increase, the focus of attention turns to what role governments should play in this environment. It was suggested to the committee that government support for scientific R&D, including biotechnology, should focus on such elements as a strong fundamental research base, major cutting edge facilities and stimulating cluster development.²⁴ The GRDC, for example, has proposed that government should provide the infrastructure and the research personnel to operate it, while industry pays for projects carried out using the infrastructure and personnel.²⁵ Recommendations made in a major review of the future needs for health and medical research touched on similar matters: a coherent approach to

21 Cooperative Research Centres Association, Submission no. 40, p. 9; Grain Biotechnology Australia, Submission no. 68, p. 2.

22 'Collaborations essential for food in the developing world', *Nature*, vol 401, 28 October 1999, p. 829; National Farmers' Federation, Submission no. 36, p. 11.

23 Western Australian State Agricultural Biotechnology Centre, Submission no. 10, p. 2.

24 Cotton Research and Development Corporation, Submission no. 27, pp. 7-8; *Developing Australia's Biotechnology Future: Discussion Paper*, September 1999, Biotechnology Australia, pp. 24-5; Innovation Summit, Resource and Infrastructure Consolidation and Cooperation Working Group, Executive summary, Melbourne, 9-11 February 2000, pp. 7-8.

25 Grains Research and Development Corporation, 'Business-like GRDC wants more value for research dollar', Media release, 5 April 2000.

infrastructure funding, increased support for research, and fostering of geographic clusters of biotechnology and research organisations.²⁶

5.17 Providing government support for the basic infrastructure needed for gene technology and its application was seen as more appropriate than funding for specific projects. Some of the advantages of this approach are:

- preventing confusion over the ownership of IP;
- allaying public concern over the use of government funds; and
- ensuring that 'a threshold level of activity exists'.²⁷

5.18 The committee considers that, in addition to targeted funding for commercial and emerging sectors, the government should contribute to the basic research that underpins the application of gene technology to agriculture. Such research is vitally important as the basis for further R&D and to provide opportunities for commercialisation by Australian companies. It also gives Australian businesses easier access to IP than if they have to rely on foreign owned IP, and something with which to bargain when negotiating access to other people's technologies.

5.19 The committee is aware that substantial funding for biotechnology research (\$250 million annually) is already provided by the Commonwealth government.²⁸ The committee considers that this research is essential and support for it should continue. It also believes that greater input to this research should be provided by the private sector, possibly through research partnerships.

Recommendation 11

5.20 **The committee recommends that the Commonwealth government:**

- **continue to contribute funding for the basic gene technology research required for applications to agriculture, fisheries and forestry; and**
- **seek more involvement, possibly through partnerships, of private sector involvement in this research.**

26 *The Virtuous Cycle: Working Together for Health and Medical Research: Health and Medical Research Strategic Review*, 1999, pp. 3, 7.

27 Ag-Seed Research, Submission no. 31, p. 10.

28 Senator Nick Minchin, *Senate Hansard*, 11 May 2000, p. 13770.

Utilising publicly funded research

- 5.21 There are several trends in gene technology R&D that impact on primary producer access to publicly funded gene technology, or are likely to do so.
- Publicly funded plant breeders are being encouraged to aggressively protect their IP and maximise the return on the public's investment in it.
 - Alliances are being formed between public and private sector organisations to research, develop and commercialise GMOs.
- 5.22 Several submissions to the inquiry noted these trends with some concern.²⁹ They emphasised that the outcome of publicly funded research must be readily available in Australia. Grain Biotechnology Australia, for example, suggested that IP developed at taxpayer expense or through grower levy funds should be made available on a competitive basis to Australian companies or multinationals with a clear R&D commitment in Australia.³⁰ Frontier Seeds called for publicly funded IP to remain in Australia for commercialisation by Australian companies, and the Western Australian government stressed the importance of mechanisms to ensure that it is available to other publicly funded Australian scientists at a reasonable cost and with minimum restrictions.³¹ The CRCA indicated that publicly available technology should be freely used by the public and small plant breeders.³²
- 5.23 There was concern that primary producers should not fund research and then be called on to pay further for the fruits of that research.³³ The NFF stated that it would be 'unpalatable' to Australian farmers to pay significant premiums to benefit from gene technology 'when the initial research has been publicly or industry funded, sold to a multi-national and then brought back to Australia'.³⁴
- 5.24 Publicly funded R&D organisations must make difficult decisions about the way in which they make their output available to others. Some of the dilemmas that face them are described in detail in the chapter dealing with IP protection (Chapter 6). Organisations such as CSIRO and the GRDC have developed policies to address this issue. The GRDC's first objective is to optimise economic benefits to the grains industry and the nation as a whole while CSIRO, when licensing its IP overseas, ensures

29 For example, NSW Farmers' Association, Submission no. 38, p. 3.

30 Grain Biotechnology Australia, Submission no. 68, p. 4.

31 Western Australian government, Submission no. 48, p. 2; Frontier Seeds, Submission no. 32, p. 2.

32 Cooperative Research Centres Association, Submission no. 40, p. 9.

33 NSW Farmers' Association, Submission no. 38, p. 7.

34 National Farmers' Federation, Submission no. 36, p. 10.

that Australian interests are not disadvantaged.³⁵ In a 1999 paper published by BA, it was suggested that the guiding principle in such cases must be to maximise the commercial benefits to Australia. At the same time, consideration must be given to creating wealth and new jobs and providing benefits to health, the community and the environment.³⁶

- 5.25 Some research grants are currently provided on the condition that approval is obtained if the resultant IP is licensed or sold.³⁷ However, the implementation of the guiding principle set out above becomes more difficult when the research being commercialised has been carried out in joint ventures,³⁸ and it can hamper further use of the research.³⁹ At a private meeting in Perth, the committee was told about several multinational companies that avoid any involvement in joint projects with the public sector.
- 5.26 BA's discussion paper suggested that 'a review of the existing arrangements to encourage the maximisation of benefit from publicly funded R&D might be warranted'.⁴⁰ The NFF made a similar point, calling for a joint industry-government investigation of the barriers to the commercialisation of publicly funded biotechnology research.⁴¹
- 5.27 The committee believes that it is very important to get the right balance between providing incentives for commercialisation and giving benefits to growers and all Australians from public investment in agricultural biotechnology research. The committee recognises that finding the balance between these two goals can be difficult. The committee understands that some publicly funded bodies have been more successful than others in finding this balance, and urges all such bodies to examine carefully the full implications of their policies.

35 CSIRO, Transcript of evidence, 18 October 1999, p. 218; Grains Research and Development Corporation, Submission no. 47, p. 7.

36 *Developing Australia's Biotechnology Future: Discussion Paper*, September 1999, Biotechnology Australia, p. 26.

37 *Developing Australia's Biotechnology Future: Discussion Paper*, September 1999, Biotechnology Australia, p. 26.

38 Grains Research and Development Corporation, Submission no. 47, p. 8; NSW Farmers' Association, Submission no. 38, p. 6.

39 In private meetings with staff from CAMBIA and Uniquist, the committee heard of the extent to which insistence on control by some R&D corporations has stymied commercialisation.

40 *Developing Australia's Biotechnology Future: Discussion Paper*, September 1999, Biotechnology Australia, p. 26.

41 National Farmers' Federation, Submission no. 36, p. 21.

Recommendation 12

- 5.28 **The committee recommends that the Commonwealth government review the current arrangements in place regarding gene technology research and ownership of intellectual property to ensure maximum commercial benefit for Australian industry.**
- 5.29 The committee also considers that a parallel investigation carried out by RDCs could result in improved practices and recommends accordingly. Among those who should be involved in this process is the Rural R&D Chairs Committee, which comprises the chairs and managing/executive directors of all RDCs and deals with matters of common interest.⁴²

Recommendation 13

- 5.30 **The committee recommends that, in conjunction with the review proposed in Recommendation 12:**
- **each research and development corporation review its practices in relation to commercialisation and ownership of intellectual property to maximise benefits to Australian industry; and**
 - **the committee of the chairs and managing directors of the rural research and development corporations, in conjunction with Agriculture, Fisheries and Forestry Australia and industry, take a lead role in assessing and disseminating best practice arrangements.**

Australian breeding programs

- 5.31 The germplasm developed in Australian breeding programs is the outcome of many years of crossing and selection, and is well adapted to our climatic, soil and disease characteristics. It is the basis for developing new varieties for use here by both Australian and overseas businesses. It is, in fact, one of Australia's bargaining chips in accessing gene technologies from overseas. As the New South Wales government pointed out:

42 Rural R&D Chairs Committee, Submission no. 49, p. 2.

If an overseas company wanted to begin plant breeding using gene technology in Australia, it would save a great deal of time and effort if it could gain access to the advanced breeding lines of our breeding programs. ... This has happened in several instances eg. Bt cotton and 'Round up Ready' canola.⁴³

The development of Ingard[®] cotton is described in Box 5.1. Another example of such an arrangement was described by the Victorian government. Its Department of Natural Resources and Environment, Monsanto, the GRDC and other collaborators are providing the germplasm, facilities and expertise needed to develop glyphosate tolerant canola varieties.⁴⁴

Box 5.1 The development of Ingard[®] cotton in Australia

Ingard[®] cotton was first grown commercially in Australia in 1996. Ingard[®] refers to cotton varieties that carry genes from the bacteria *Bacillus thuringiensis* which produces an insecticidal protein toxin known as Bt. It was developed from the US GM cotton Bollgard[®]. The Ingard[®] gene technology is owned by Monsanto and has been incorporated into Australian cotton varieties by CSIRO and Deltapine researchers. The transformed material has been commercialised by Cotton Seed Distributors (CSD) and Deltapine. Monsanto's agreements with CSD and Deltapine cover the development and marketing of the seed, but allow Monsanto to independently negotiate contracts with growers over the sale of Ingard[®]'s insect protein.

Source: Australian Biotechnology Association, Submission no. 39, p. 4; Cotton Research and Development Corporation, Submission no. 27, p. 4; Monsanto Australia, Submission no. 44, p. 2.

5.32 The committee heard that some of Australia's plant breeding programs are less than fully efficient. For example, at a private meeting with Western Australian businesses, the committee was told that the nine wheat breeding programs in the country should contract to three to reduce the replication of effort and improve their efficiency. Ag-Seed Research and the Western Australian government made similar points about decreasing the number of programs.⁴⁵ Another concern is that these programs tend to have a strong state focus; a wider focus would be more appropriate.

43 New South Wales government, Submission no. 72, p. 11.

44 Victorian government, Submission no. 67, p. 4.

45 Ag-Seed Research, Submission no. 31, p. 10; Western Australian government, Transcript of evidence, 27 July 1999, p. 4.

- 5.33 The committee believes that it is critical that Australian farmers are served by the best programs possible. It suggests that the Commonwealth government should facilitate the process of ensuring that efficient breeding programs exist.

Recommendation 14

- 5.34 **The committee recommends that the Commonwealth government, in conjunction with state and territory governments and the private sector:**
- **review the efficiency and effectiveness of plant breeding programs in Australia;**
 - **identify ways of improving them; and**
 - **promote their adoption, particularly where Commonwealth funding is provided.**

Recommendation 15

- 5.35 **The committee recommends that the Commonwealth government, in conjunction with state and territory governments and the private sector, consider the benefits of amalgamating some of the existing plant breeding programs.**

- 5.36 Successful commercialisation of gene technology requires the pairing of the right technology with the right germplasm.⁴⁶ In this connection, concern has been expressed about the wide scale buying out of seed companies by the major gene technology corporations.

A disadvantage of this trend is that seed companies become captive to their new owner's biotechnology and may not have the freedom to choose what may be better technology from other suppliers. Certainly the ability to 'mix and match' various desirable traits from different sources will be curtailed.⁴⁷

- 5.37 CSD made the same point: 'the ability to commercialise traits from other entities is therefore limited, which may in fact be somewhat limiting to grower benefit in the end'.⁴⁸ The Cotton Research and Development

46 Cotton Research and Development Corporation, Submission no. 27, p. 5.

47 Cotton Research and Development Corporation, Submission no. 27, pp. 5-6.

48 Cotton Seed Distributors Ltd, Transcript of evidence, 18 October 1999, p. 235.

Corporation suggested that Australian farmers' access to GM seed would be improved if seed companies and distribution remained in Australian, and preferably growers', hands.⁴⁹ The committee appreciates the concerns of Australian growers on this point, but does not believe that there is a role for government in this matter, beyond what might be determined by competition law.

- 5.38 Breeding programs often draw on the holdings of plant genetic resource centres. In the case of the grains industry, there are seven centres in Australia which cover winter cereals, temperate and tropical forage crops, medicago, tropical and temperate field crops, and indigenous wild relatives of crops. The centres are operated by CSIRO and all state agriculture departments except Tasmania. They provide accessions on demand and obtain appropriate accessions that may be valuable to Australian agriculture.⁵⁰
- 5.39 At a private meeting with Western Australian grain growers, the committee was told that the germplasm relevant to that industry was likely to be well maintained. There were concerns, however, that what are now publicly held collections could be sold. The committee is aware that New Zealand's germplasm centre has been privatised, and a review is being carried out into the role and functions of Australia's collections by the Standing Committee on Agriculture and Resource Management (SCARM).
- 5.40 The committee recognises that the future of these centres is a matter for the states that operate them, but would be concerned if the centres were sold into private hands. The committee believes that there is a role here for the Commonwealth government to develop a national policy with state and territory governments and industry for the maintenance and accessibility of the germplasm.

Recommendation 16

- 5.41 **The committee recommends that the Commonwealth government, together with state and territory governments and industry, develop a policy for maintaining Australia's germplasm collections and continuing to make them accessible.**

49 Cotton Research and Development Corporation, Submission no. 27, p. 7.

50 Grains Research and Development Corporation, Submission no. 47, pp. 13-14.

- 5.42 Some of the germplasm to which Australian researchers have access comes from international collections, for example, the International Maize and Wheat Improvement Center in Mexico and the International Rice Research Institute at Manila in the Philippines. It is important that these centres continue to receive support.⁵¹ However, the environment in which they are operating has changed in recent years.
- 5.43 An international instrument on genetic resources, the Food and Agriculture Organization's (FAO) International Undertaking on Plant Genetic Resources, recognised plant genetic resources for food and agriculture as the common heritage of mankind. It provided for free exchange of such material between countries. According to the GRDC, the Convention on Biological Diversity, which came into force in 1993, has changed the focus here in a way that could be detrimental. The convention recognises national sovereignty over genetic resources and provides for access to them only on the basis of mutually agreed, informed consent. The FAO's Plant Genetic Commission has been working for several years to 'harmonise' the International Undertaking on Plant Genetic Resources with the Convention on Biological Diversity, but has been unsuccessful to date because of opposition from some third world countries.⁵²
- 5.44 The GRDC feared that 'increased competition for valuable genetic material and decreasing government aid for international research agencies may reduce Australia's access to genetic material in the future'.⁵³ It claimed that:
- It is likely that the interests and concerns of Australian agriculture are not being given sufficient weight relative to the interest of overseas conservation and indigenous groups in developing the Australian negotiating position for this international instrument. The current situation in Australia is unsatisfactory from the point of view of the agricultural industries. This issue should be a high priority for the ... Biotechnology Australia program.⁵⁴
- 5.45 The committee supports the need for access by Australian growers to the best germplasm from international sources. It believes that it is important for the Australian government's contribution to the existence of the international centres, through organisations such as the Australian Centre for International Agricultural Research, to continue.

51 Heritage Seed Curators Australia, Submission no. 30, p. 2.

52 Grains Research and Development Corporation Submission no. 47, p. 14.

53 Grains Research and Development Corporation Submission no. 47, p. 13.

54 Grains Research and Development Corporation Submission no. 47, p. 14.

Recommendation 17

5.46 **The committee recommends that the Commonwealth government continue to contribute to the operation of the international germplasm centres.**

5.47 The committee acknowledges concerns about access to the international germplasm collections. However, it is aware that the same international agreements that may limit this access will also enable Australia to benefit from access by overseas interests to Australia's own natural resources.

Recommendation 18

5.48 **The committee recommends that the Commonwealth government:**

- **play a major role in international negotiations to harmonise the International Undertaking on Plant Genetic Resources with the Convention on Biological Diversity; and**
- **take a position that balances the interests of those who wish to import genetic resources from overseas with maximising Australia's benefit from its native genetic resources.**

Access to native genetic resources

5.49 The Australian continent is biologically mega diverse. Its biological resources represent a source of genetic potential that will become increasingly important. Access to this resource is being developed at a policy and regulatory level as part of BA's program, as EA pointed out. The ownership of biological resources is being clarified, a national system of biological resource centres accelerated, and industry access to the documentation of biological resources improved.⁵⁵ An inquiry into some of these matters is under way at present and will advise on their implementation through regulations under the *Environment Protection and Biodiversity Conservation Act 1999*. The inquiry will be completed by 30 June 2000.⁵⁶

55 Environment Australia, Submission no. 82, pp. 23-4.

56 Senator the Hon. Robert Hill, Minister for the Environment and Heritage, 'Inquiry to examine access to biological resources', Media release, 22 December 1999.

Commercialisation

- 5.50 Many studies over the last few decades have investigated Australia's record of R&D and the commercialisation of the fruits of this R&D. There has been general agreement that, in a number of fields, Australia's research has been of a high standard, if not of world class quality. Australia's record in agricultural biotechnology research was described to the committee as 'strong',⁵⁷ and its position as being 'at the forefront of genetic manipulation leading to improved breeds of cattle and sheep and crop varieties'.⁵⁸
- 5.51 However, Australia has been generally less successful in bringing its innovations on to the market than it has been in conducting the underlying research and preliminary development. Australian research has frequently been commercialised overseas, and has then been imported back into this country. As a result, few of the benefits have gone to Australian companies. Within this general context, the committee expected that it would find evidence of a similar situation in the commercialisation of Australian agricultural gene technology.
- 5.52 Successfully commercialising the results of gene technology research depends on a number of factors.
- Firstly, the IP produced by the research must be protected and that protection enforced. Access to any IP that is owned by other people must be negotiated. These are complex tasks and can be costly. They are discussed further in Chapter 6.
 - Secondly, the GM products of the research must satisfy local regulatory requirements for local commercial release, and meet the requirements of export destinations when exported. Until recently, the regulatory pathway to commercial release of GMOs in Australia was unclear and represented a deterrent to commercialisation. Requirements for labelling GM foods will also have implications for the cost of providing GM food to the market. These requirements have not yet been decided. The regulation of GMOs is covered in Chapter 7.
 - Thirdly, access to capital is needed to meet the costs of:
 - ⇒ the original research, or getting access to it;
 - ⇒ IP protection;
 - ⇒ meeting regulatory requirements; and

57 National Farmers' Association, Submission no. 36, p. 7.

58 Australian Biotechnology Association, Submission no. 39, p. 5.

⇒ commercial production of the GMO. The sums required are very considerable.

- Lastly, a market for GMOs depends on consumer acceptance which is not yet forthcoming from all sections of the community. Chapter 3 deals with consumer attitudes to GMOs.

5.53 With the cost of research, IP protection and enforcement, and meeting regulatory requirements, the process of commercialising gene technology research is clearly an expensive business. The commercialisation and marketing of agricultural and livestock production varieties is complex, cumbersome and costly.⁵⁹ According to Novartis:

It is generally more expensive to develop genetically modified varieties and bring them to market than conventional varieties, because of the additional research and development work and additional regulatory requirements.⁶⁰

These regulatory requirements may include the implementation of post release management plans and monitoring environmental impacts.⁶¹

5.54 The expense entailed in bringing research to the market may be beyond the capacity of many Australian firms. For example, Ag-Seed Research suggested that:

... any program developing gene technology products, will need to spend at least \$400,000 p.a. and desirably around \$1m p.a. on relevant R&D. Ag-Seed Research itself currently spends \$1.5m p.a. on oilseed brassica development, and we are only now commencing to develop GMO-based canola.⁶²

BA's discussion paper on biotechnology revealed that:

The cost of developing a biotechnology application or product from laboratory bench through to market release is generally prohibitive for most Australian firms unless they work in partnership with companies or obtain financing from overseas.⁶³

5.55 In addition, one of the characteristics of Australia's industrial scene is that there are few locally owned agricultural input suppliers. As a result:

When Australian researchers make a commercially valuable discovery, there may not be a local firm able and willing to

59 Australian Barley Board Submission no. 60, p. 7; CSIRO, Submission no. 56, p. 3.

60 Novartis, Submission no. 26, p. 5.

61 Victorian government, Submission no. 67, p. 3.

62 Ag-Seed Research, Submission no. 31, p. 9.

63 *Developing Australia's Biotechnology Future: Discussion Paper*, September 1999, Biotechnology Australia, p. 27.

complete the development and bring the product to market, or with the international infrastructure to sell it effectively worldwide and thereby maximise the return.⁶⁴

Forming alliances, which is discussed in the next section, is a recent development that overcomes some of these problems.

- 5.56 Start up companies and industry bodies were also identified to the committee in private meetings as possible means of commercialising R&D. However, in some industries it is not easy for those involved in R&D to identify the most relevant industry body to approach when seeking to commercialise their work.

Licensing, joint ventures and strategic alliances

- 5.57 Under the circumstances outlined in the last section, Australian researchers frequently choose to commercialise their discoveries by licensing their technologies to companies overseas. Alternatively, they seek to use them as bargaining chips to negotiate access for Australian interests to overseas owned technologies. As the CRC for Tropical Plant Pathology pointed out:

Most genetically modified crop plants require a combination of several gene technologies to be successful. ... In modern biotechnology there is a considerable amount of cross-licensing where technologies are exchanged for mutual commercial gain. This means that Australian research institutes that have valuable intellectual property in gene technologies may be able to trade licenses for these technologies for access to other valuable gene technologies controlled by companies outside Australia. This is particularly important to obtain access to the enabling technologies. This would mean that the small Australian producer and breeder can access all the required licenses for Australian developed technologies plus the required enabling technologies controlled by overseas companies.⁶⁵

- 5.58 According to a survey of 90 companies by Ernst & Young, Australian biotechnology companies are very active in licensing activities. Licences were most frequently acquired from overseas; Australian universities were the second most frequent source.⁶⁶ In a private meeting with the committee, CAMBIA's chairman, Dr Richard Jefferson, warned that, if in-licensing is very widely practised, Australia might become no more than a

64 Agriculture, Fisheries and Forestry Australia, Submission no. 77, pp. 5-6.

65 Cooperative Research Centre for Tropical Plant Pathology, Submission no. 21, p. 3.

66 V Santer, 'Intellectual property and patent issues', in Ernst & Young, *Australian Biotechnology Report 1999*, Commonwealth of Australia, 1999, pp. 35-6.

contract research agency and lose its inventive capability. With out-licensing, the downsides are the financial cost and the potential for loss of control.

- 5.59 One of the points stressed in several submissions was that companies entering into licensing arrangements should ensure that they negotiate the rights to export their products. Since much of our produce is exported and the cost of bringing GM varieties to market are considerable, rights to overseas export of the products of gene technology must not be compromised.⁶⁷ It was therefore disappointing that CSD was excluded by Monsanto from selling its transgenic cotton seed in the international market.⁶⁸
- 5.60 The GCA pointed out that, despite the difficulties, there are many cases where there is little alternative for Australian companies but to enter into arrangements with multinational companies in order to be able to effectively develop and market their gene technology IP. If the Australian grains industry is to remain internationally competitive, 'Australian companies will have no choice but to enter into joint ventures with the large multinational players if gene technology products are to be developed effectively in Australia'.⁶⁹ Other witnesses to the inquiry made a similar point.⁷⁰
- 5.61 Several examples of strategic alliances were brought to the committee's attention. They include Graingene which is described in Box 5.2. In another strategic alliance, CSIRO has patented a gene that controls the browning process in many fruits and vegetables. The gene has been licensed to Zeneca for worldwide use in bananas. The contract requires Zeneca to make these new bananas available to Australian growers as soon as they are available in the marketplace, and on terms that are at least as favourable as anywhere else in the world.⁷¹

67 Australian Raw Sugar Industry, Submission no. 64, p. 10; Western Australian government, Submission no. 48, p. 2.

68 CSIRO, Submission no. 56, p. 21.

69 Grains Council of Australia, Submission no. 65, p. 12.

70 Cooperative Research Centres Association, Submission no. 40, p. 9; Western Australian State Biotechnology Centre, Submission no. 10, p. 2.

71 Avcare, Submission no. 61, p. 6.

Box 5.2 Graingene

Australia is utilising strategic alliances with multinational companies to gain entry into global agribusiness. Without access to IP generated by these companies, Australian growers may be put at a significant disadvantage. Graingene is an example of such an alliance.

Graingene was formed in April 1999 and is a joint venture between AWB, CSIRO and the GRDC. Graingene aims to carry out plant biotechnology research, generate IP, create commercialisation opportunities for Australian grains, and enhance Australia's investment capability in new technologies.

It is anticipated that Graingene will generate strong linkages between plant breeding and advances in biotechnology, have a strong negotiating capability, a powerful IP position, improve access to key technologies, and develop a wide range of international marketing opportunities.

Graingene's research programs include:

- genomics;
- new breeding and production specification technologies;
- yield increase and performance traits;
- resistance to pests and diseases;
- crop nutrition and abiotic stress; and
- product quality.

It is envisaged that Australian and international research organisations and companies will be invited to participate in the alliance through involvement in individual research projects.

Source: Agriculture, Fisheries and Forestry Australia, Submission to the Innovation Summit, <http://www.isr.gov.au/industry/summit/reference/sectoral/index.html>, accessed 27 April 2000; AWB Ltd, Submission no. 66, pp. ii, 6; Grains Research and Development Corporation, Submission no. 47, p.8.

- 5.62 To form effective strategic alliances or develop alternative technologies, a strong national capability is needed. If Australia is not well served in this respect, 'it runs the risk of becoming relegated to being a marginal, dependent player in this key research field'.⁷² Other submissions to the inquiry stressed the importance of such arrangements, underpinned by a strong local capability in gene technology.⁷³ The committee has already made a recommendation earlier in this chapter about funding to provide a strong national R&D capacity in gene technology
- 5.63 Domination of gene technology by a few large firms could result in the extraction of monopoly rents or restricted access to this technology for Australians. This situation is likely to be exacerbated by further rationalisation of the sector as further international mergers and acquisitions occur.⁷⁴

The major multinational corporations have Australian subsidiaries that now control much of the gene technology intellectual property in Australia. These subsidiaries are increasingly looking to enter into joint ventures with smaller Australian companies. ...

Any difficulties that arise in relation to dealings and arrangements between Australian companies and multinationals could have the potential to both restrict Australia's access to internationally developed gene technologies and also to hinder the marketing of Australian developed intellectual property.⁷⁵

The Centre for Legumes in Mediterranean Agriculture (CLIMA) suggested that, by their actions, multinational companies were acting to reduce competition for their core species 'by ensuring that access to IP is not made available to potentially competing species'.⁷⁶

- 5.64 From other input to the inquiry, however, the committee learnt that such fears were considered by some to be exaggerated or unfounded.⁷⁷ Furthermore, some of the reluctance of multinational companies to make their technology available may relate to regulatory hurdles, liability concerns and uncertainty over IP issues.⁷⁸

72 Grains Research and Development Corporation Submission no. 47, p. 9.

73 Victorian government, Submission no. 67, p. 3; Western Australian government, Submission no. 48, p. 2.

74 Grains Council of Australia, Submission no. 65, p. 11.

75 Grains Council of Australia, Submission no. 65, p. 12.

76 Centre for Legumes in Mediterranean Agriculture, Submission no. 14, p. 4.

77 Grain Biotechnology Australia, Submission no. 68, p. 4.

78 Western Australian government, Submission no. 48, p. 2.

Investment in commercialisation

- 5.65 According to Dr Brooke of Rothschild Bioscience Managers, 'the great financing challenge for Australian biotechnology companies is bridging the gap between world class commercialisable primary science and listing on the public market'. Finance for commercialising research can be sourced from government sources, corporate deals, private investors (angels), public markets, and venture capital, or a combination of these.⁷⁹ A particular impediment is the lack of venture capital for early stage developments.⁸⁰
- 5.66 Recognising these problems, the government charged BA with developing a national strategy for biotechnology which will ensure that Australia captures the benefits from applying biotechnology in medicine, agriculture and the environment. In September 1999, BA put out an issues paper to focus attention on the priority issues, which included the financial aspects of commercialisation. The National Biotechnology Strategy has been developed on the basis of extensive consultation with stakeholders.⁸¹ It will be announced soon.

Tax incentives

- 5.67 Given that gene technology is a high risk undertaking, it is not surprising that submissions to the inquiry called for incentives to encourage its use and development. Australia's tax regime was seen as failing to provide an adequate stimulus to private investment in R&D. Ag-Seed Research emphasised the importance of 'tax incentives along the lines of:
- minimum 150% claims for R&D expenditure; and
 - accelerated depreciation on capital items, together with export incentives'.⁸²
- Others also made these points.⁸³
- 5.68 A group meeting at the Innovation Summit held in Melbourne in February 2000 concluded that the R&D tax concession had been a primary incentive for innovation and should be retained on a long term basis. The group was concerned, however, at the erosion of the concession in light of reduction

79 G Brooke, 'Overview of venture financing in Australia', in Ernst & Young, *Australian Biotechnology Report*, Commonwealth of Australia, 1999, p. 22.

80 *Developing Australia's Biotechnology Future: Discussion Paper*, September 1999, Biotechnology Australia, p. 28.

81 Biotechnology Australia, 'Biotechnology - framework for the future', <http://www.isr.gov.au/ba/framework.html>, accessed 1 June 2000.

82 Ag-Seed Research, Submission no. 31, p. 9.

83 For example, participants at the committee's private meeting in Perth.

in the company tax rate and suggested that increasing the concession should be considered.⁸⁴

- 5.69 The absence of a viable venture capital market in Australia has been attributed to an income tax system that is not conducive to risk taking,⁸⁵ particularly our capital gains tax regime.⁸⁶ The Wills report on health and medical research made the same point.⁸⁷ The NFF went into some detail on this matter:

The Australian capital gains tax system discriminates against risky investments because of its asymmetric treatment of losses and gains. Realised capital gains are taxed immediately as income, whereas realised capital losses can only be carried forward and offset against current or future capital gains. ...

Many OECD countries, and most of Australia's trading competitors, allow taxpayers to offset current years losses against the tax paid in the previous three years. Compared to carry-forward tax losses, the carry-back of losses provides the firm with cash-flow when it is losing money, rather than lower taxes when the firm returns to profitability.

Similarly, many OECD countries provide a more generous capital gains regime than Australia. In particular, the UK 'stepped rate' proposals appear to provide a model that Australia could well emulate.⁸⁸

- 5.70 The comments summarised above were made before recent changes to business taxes following the government's review of business taxation. The changes make Australia's tax regime more competitive with those overseas. They include lowering the company and capital gains tax rates for Australian businesses, and exempting Australian superannuation and overseas pension funds from capital gains tax. Such changes are expected to attract major investments.⁸⁹

84 'National Innovation Summit' Melbourne, 9-11 February 2000, pp. 4-5, <http://www.isr.gov.au/industry/summit/ois/communique.doc>, accessed 7 March 2000.

85 Dr Brian Booth, Submission no. 7, p. 7.

86 Agriculture, Fisheries and Forestry Agriculture, Submission no. 77, p. 6.

87 *The Virtuous Cycle: Working Together for Health and Medical Research: Health and Medical Research Strategic Review*, 1999, p. 7.

88 National Farmers' Federation, Submission no. 36, pp. 11-12.

89 Biotechnology Australia, 'Biotechnology and innovation in Australia', Submission to the Innovation Summit, February 2000, p. 10; K Hardy, 'Tax issues in the biotechnology industry', in Ernst & Young, *Australian Biotechnology Report 1999*, Commonwealth of Australia, 1999, p. 46.

- 5.71 A number of other suggestions for providing incentives for investment in innovative projects came to the committee's attention. Participants at the Innovation Summit noted that greater incentives are provided for investment in established public companies than in loss making start up ventures. They recommended the use of a sliding scale capital gains tax regime that is only applicable to investments in innovation based companies, as happens in the UK.⁹⁰ BA also proposed that additional incentives be considered for investment in unlisted, local start up and early phase ventures.⁹¹
- 5.72 The committee welcomes the incentives to investment in biotechnology that are expected to flow from the changes to business tax arrangements. It considers, however, that the extent to which investment is stimulated must be monitored so that further measures can be pursued if needed to provide further stimulus.

Recommendation 19

- 5.73 **The committee recommends that the Commonwealth government:**
- **monitor the impact of the new business tax arrangements on the level of investment in biotechnology; and**
 - **implement further changes to taxation arrangements if further stimulus to invest is needed.**
- 5.74 From the evidence before it, the committee identified two areas which should be paid particular attention in relation to encouraging investment in commercialising biotechnology R&D. They are the apparent erosion of the R&D concession because of the reduction in company tax rates and the need for more support for the early stages of commercialisation. The committee considers that, if these matters are not addressed by the National Biotechnology Strategy, they should be reviewed in conjunction with the monitoring of the impact of the new business tax arrangements proposed above.

90 'National Innovation Summit' Melbourne, 9-11 February 2000, p. 9, <http://www.isr.gov.au/industry/summit/ois/communique.doc>, accessed 7 March 2000.

91 Biotechnology Australia, 'Biotechnology and innovation in Australia', Submission to the Innovation Summit, February 2000, p. 10.

Grant incentives

- 5.75 Until the announcement in the last budget, there were no programs dedicated to commercialising biotechnology research. There were, however, a number of Commonwealth programs that support the commercialisation of research in general. The 2000-2001 budget changes this situation; it provides an extra \$20 million for assistance to the early stages of commercialising biotechnology.⁹²
- 5.76 The existing programs open to gene technology businesses are described below.⁹³
- The R&D Start program provides grants and loans of up to 50 per cent of total expenditure over three years, predominantly to start up companies which are unlikely to be profitable in the early years.
 - The Commercialising Emerging Technologies (COMET) program is providing \$30 million over three years to mentor individuals and companies through the pre-seed stage of commercialisation.
 - The Innovation Investment Fund (IIF) provides access to government funds through five licensed venture capital firms. Funds are available at the rate of two to one for investment in the early stages of a technology venture. It is expected that between \$500,000 and \$3 million will be given to each investment, with a total Commonwealth allocation of \$230 million.
 - Pooled Development Funds (PDFs) are investment companies that receive a concessional 15 per cent tax rate for equity investments in growing small companies, including high technology start-ups, with less than \$50 million of total assets at the time of investment. Capital gains from sales of shares in PDFs are free from capital gains tax. Dividends paid by PDFs are exempt from income tax and dividend withholding tax.

92 Sen the Hon Nick Minchin, '\$4.5 billion record level for science and technology' Media release, 11 May 2000.

93 *Budget Papers: Budget 2000-2001: Budget Papers No. 2: Budget Measures Part II: Expense Measures: Industry, Science and Resources*; K Hardy, 'Tax issues in the biotechnology industry', in Ernst & Young, *Australian Biotechnology Report 1999*, Commonwealth of Australia, 1999, p. 47; Senator the Hon Nick Minchin, 'Budget 2000-2001: Empowering industry to invest in innovation and grow', Media release, 9 May 2000.

- The Technology Diffusion Program assists industry and researchers to access and adopt new and leading-edge technologies developed in Australia or overseas. \$101.8 million is available over four years for this program. In the 2000-2001 budget, \$6.6 million were reallocated from this program to the National Biotechnology Strategy.⁹⁴
- 5.77 R&D Start, IFF and PDFs were assessed by Dr Brooke as having drawn significant resources to seed and early stage ventures with the assistance of experienced venture capital investors. With improvements to the tax system and better skills in the management of early stage biotechnology companies, there is promise of more successful commercialisation of Australian biotechnology. Participants at the Innovation Summit suggested that the IIF and PDF programs be expanded.⁹⁵
- 5.78 The committee is aware of some criticisms of these schemes. The Wills report commented on the fact that government programs tend to change frequently and unpredictably, and some involve government committees or public servants picking winners. It also made the point that 'support for biotechnology, with its long time frames and compliance work is rare despite the potentially high rewards'.⁹⁶ The review suggested the effectiveness of PDFs and the IIF in raising capital for biotechnology should be reviewed after the reform of the business tax system. If the schemes are found to be wanting, alternatives should be explored.⁹⁷
- 5.79 A further suggestion was for additional assistance at earlier stages in the process of R&D and commercialisation than most of the above schemes cover.⁹⁸ While the COMET program goes some way to filling the gap here, it is insufficient. Overseas experience suggests that an incubator program is useful in providing the necessary expertise, particularly in cases where public sector researchers are involved in setting up spin off companies. A working group at the Innovation Summit proposed the urgent establishment of an incubator program for biotechnology, like the one already in place in Australia for information technology.⁹⁹

94 G Brooke, 'Overview of venture financing in Australia', in Ernst & Young, *Australian Biotechnology Report 1999*, Commonwealth of Australia, 1999, p. 23.

95 'National Innovation Summit' Melbourne, 9-11 February 2000, p. 9, <http://www.isr.gov.au/industry/summit/ois/communique.doc>, accessed 7 March 2000.

96 *The Virtuous Cycle: Working Together for Health and Medical Research: Health and Medical Research Strategic Review*, 1999, pp. 152-3.

97 *The Virtuous Cycle: Working Together for Health and Medical Research: Health and Medical Research Strategic Review*, 1999, p. 156.

98 *The Virtuous Cycle: Working Together for Health and Medical Research: Health and Medical Research Strategic Review*, 1999, p. 156.

99 Innovation Summit, Resource and Infrastructure Consolidation and Cooperation Working Group, Executive summary, Melbourne, 9-11 February 2000, p. 6.

- 5.80 The committee believes that the Commonwealth government should continue to support successful grant schemes. It agrees with the suggestion reported above that the operation of the existing schemes should be reviewed after the impact of business tax reform can be established. Such a review should take into account the particularly long time frames associated with the commercialisation of biotechnological applications. The committee considers that this review should be linked with that of the taxation arrangements proposed in Recommendation 19.

Recommendation 20

- 5.81 **The committee recommends that, when reviewing the impact of the new business tax arrangements on the level of investment in biotechnology, the Commonwealth government also review:**
- **the contribution of grant programs and the 125 per cent tax concession for research and development; and**
 - **the need for more support, through grants and taxation measures, for investment in the early stages of commercialisation.**
- 5.82 The committee is aware of the value of incubator centres in promoting innovative projects at early stages in their development. It believes that an incubator program would be of great assistance in stimulating the application of biotechnology to agriculture and recommends that such a program be established.

Recommendation 21

- 5.83 **The committee recommends that the Commonwealth government fund a specific incubator program to assist the application of biotechnology to agriculture.**

Marketing

- 5.84 A feature of the agricultural sector is the growing vertical integration of the supply chain that might eventually result in a direct linkage between seed suppliers and consumers' plates. AgrEvo commented on this trend.

The entry of traditional crop protection companies into seed production and biotechnology has created new opportunities and outlook on the commercialisation and marketing of the products of gene technology. AgrEvo can draw upon its experience as a leader in crop protection products and agronomic sales support to assist in the successful introduction of these products in the near future. Relationships with distributors and farmers and quality assurance systems ... are easily applicable to new seed and technology products.¹⁰⁰

Nugrain is also entering the gene technology business. Nugrain is an Australian conglomerate formed from a supplier of farming inputs (Nufarm), the nation's four largest bulk grain handlers (Vicgrain, GrainCorp, SACBH and CBH), and a leading rural merchandise business (Wesfarmers Dalgety).

- 5.85 The introduction of GM livestock to growers is also expected to be favoured by the structure of the industry.

Because of the pyramidal breeding structure of most extensive livestock industries, and the vertical integration of the intensive industries, commercialisation and marketing of genetic improvements, once these are covered by a satisfactory regulatory mechanism, should be relatively straightforward assuming that issues like animal welfare, ethics etc are appropriately dealt with. Producers of genetically enhanced livestock ... will licence the genetically enhanced animals to major breeders, who will spread them out to commercial producers and multipliers.¹⁰¹

... in general, the structure of our livestock industry will preclude the introduction of elaborate, restrictive mechanisms.¹⁰²

- 5.86 Large multinational companies with strong IP positions in gene technology have power over the market through their links down the supply chain. Concern was expressed to the committee about the power of

100 AgrEvo, Submission no. 55, p. 3.

101 CSIRO, Submission no. 56, p. 4.

102 CSIRO, Submission no. 56, p. 5.

these companies to prevent farm saving of seeds through the use of terminator technology, to require the use of specific inputs, and to dictate the varieties grown under contract to retailers.¹⁰³ The Australian United Fresh Fruit and Vegetable Association, for example, expected market domination by larger companies 'probably working with large retail chains, which restrict grower access to varieties and pesticides and will ensure premium prices will be paid for seed'.¹⁰⁴ AGN pointed out that 'this ability to monopolise agricultural inputs has never been so complete before. It represents significant departure from traditional farming practices'.¹⁰⁵

- 5.87 However, Monsanto's experience with the introduction of Ingard® cotton illustrates some of the difficulties that may be associated with marketing a GM variety. Cost, limited technical support, and the absence of 'real compensation' for poor performance were among the issues that were of concern to Ingard® cotton growers.¹⁰⁶

Skills

- 5.88 The growth of the biotechnology industry is expected to be rapid. It is estimated that around 5,000 more highly skilled and qualified people will be required in the field by 2005.¹⁰⁷

Research skills

- 5.89 AFFA's submission to the inquiry drew together information about Australia's scientific skills base in agricultural biotechnology, and expressed concern that there were 'potential deficiencies in the skills base of our researchers'. A survey by SCARM found that shortages of senior experienced staff were becoming apparent. This situation reflected several recent developments.
- Bearing in mind that 90 per cent of agricultural research is performed by the public sector, the restructuring of public administration has had a particular impact on the number of agricultural research workers employed. For example, the number employed by Commonwealth and

103 Mr Wayne Hancock, Submission no. 6, p. 4; Mr Griffiths, Submission no. 22, p. 4; Queensland Fruit and Vegetable Growers, Submission no. 42, p. 3; The O'Hallorans, Submission no. 17, pp. 2-3.

104 Australian United Fresh Fruit and Vegetable Association, Submission no. 58, p. 2.

105 GeneEthics Network, Submission no. 71, p. 8.

106 Mr Wayne Hancock, Submission no. 6, p. 4.

107 *Developing Australia's Biotechnology Future: Discussion Paper*, September 1999, Biotechnology Australia, p. 35.

state governments and in higher education fell by nearly 14 per cent between 1992-93 and 1994-95.

- There is a strong overseas demand for gene technologists, particularly in medicine and pharmaceuticals. Given that their skills are not peculiar to a particular discipline, they can move easily out of agricultural research into other fields.¹⁰⁸

5.90 It is important for Australia to have an adequate number of researchers with appropriate research skills, and support for them must be provided. If it is not, the skills will not be maintained or will go overseas.¹⁰⁹ Strategies to develop biotechnological expertise are being developed. For example, BA recognised that researchers are needed who will operate successfully in transdisciplinary research; producing such researchers requires creative university courses. These researchers will also need opportunities to interact with top researchers overseas.¹¹⁰

Business and management skills

5.91 It is widely recognised that management skills in gene technology are not of a high enough standard in the research and business community in Australia. The South Australian government claimed that:

... researchers and traditional industry funders (R&D Corporations) are required to be more conversant and proficient in the development, protection and commercialisation of intellectual property as well as be more professional in forming strategic and commercial business alliances.¹¹¹

Conversely, there is a shortage in the venture capital funds of 'dedicated expertise able to fully understand the complexities of biotechnology investment'.¹¹²

5.92 In Ernst and Young's survey of 90 companies, skilled human resources and access to smart capital (money plus management expertise) were among the top four issues nominated as needing to be addressed when successfully commercialising biotechnology.¹¹³

108 Agriculture, Fisheries and Forestry Australia, Submission no. 77, p. 5.

109 Cooperative Research Centre for Premium Quality Wool, Submission no. 52, p. 2.

110 *Developing Australia's Biotechnology Future: Discussion Paper*, September 1999, Biotechnology Australia, p. 36.

111 South Australian government, Submission no. 81, p. 11.

112 G Brooke, 'Overview of venture financing in Australia', in Ernst & Young, *Australian Biotechnology Report 1999*, Commonwealth of Australia, 1999, p. 26.

113 Ernst & Young, *Australian Biotechnology Report 1999*, Commonwealth of Australia, 1999, p. 45.

- 5.93 BA's discussion paper addressed the types of training needed to meet the demands of a developing biotechnology industry. For example, researchers must be exposed to commercial issues and Master of Business graduates to basic science concepts.¹¹⁴ The COMET program acknowledges this and supports management skills training for individuals in companies at the early stages of commercialising R&D.¹¹⁵ Training in IP issues is also needed,¹¹⁶ and is dealt with in more detail in Chapter 6.
- 5.94 More broadly, a fundamental change in culture and thinking of Australians will be required if they are to become more entrepreneurial.¹¹⁷
- 5.95 The committee views the development and maintenance of Australians' research, business and management skills as essential to the effective use of biotechnology in agriculture. It is aware of initiatives to improve the skill levels of those already involved in biotechnology research and the industry and to increase the number of skilled people. The committee considers that it is important for these initiatives to be maintained and expanded if needed.

Recommendation 22

- 5.96 **The committee recommends that the Commonwealth government continue to fund programs for increasing the numbers of people and the levels of skills in:**
- **biotechnology research; and**
 - **the business and management issues involved in the commercial use of the research.**

114 *Developing Australia's Biotechnology Future: Discussion Paper*, September 1999, Biotechnology Australia, p. 36.

115 Senator the Hon Nick Minchin, 'Budget 2000-2001: Empowering industry to invest in innovation and grow', Media release, 9 May 2000.

116 Australian Barley Board, Submission no. 60, p. 8; Cotton Seed Distributors Ltd, Transcript of evidence, 18 October 1999, p. 237.

117 'National Innovation Summit' Melbourne, 9-11 February 2000, <http://www.isr.gov.au/industry/summit/ois/communique.doc>, accessed 7 March 2000.

Cost of GM varieties

- 5.97 It is clear that GM varieties must be priced to recover, within a reasonable period of time, the expenses incurred in bringing them to market. At the same time, the pricing structure should be such as to provide profit to growers as well as other players in the production chain.
- 5.98 There was no consensus, however, on whether GM seeds would be more or less expensive than conventional varieties. AgrEvo anticipated that the cost of its GM canola seeds would be comparable to that for non GM seed.¹¹⁸ On the other hand, the cost of GM seed could be expected to be generally higher than for conventional seed because of the expense involved in developing and commercialising gene technology products.¹¹⁹ The view most often expressed to the committee was that prices would be higher.
- 5.99 Novartis explained that:
- Seeds are typically priced at a level that recognises the added benefits to the farmer, such as more efficient chemical usage, increased yield and reduced effort/time. Thus, while producers pay a premium for the seeds, this is more than offset by the reduced cost of the other inputs required to bring the crop to harvest. Thus producers can expect a higher profit from the crop.¹²⁰
- 5.100 It was suggested to the committee that the cost of GM seeds would be determined by the market, especially when the genetic enhancement was carried out in Australia.¹²¹ If there is no advantage to growers in using GM varieties, they will continue to purchase conventional varieties, and there will be pressures on the suppliers of GM seed to keep prices low. If, on the other hand, a GM variety is demonstrably superior, it will command a higher price.¹²² The cost of gene technology will be what the market can bear.¹²³

118 AgrEvo, Submission no. 55, p. 3.

119 Grains Council of Australia, Submission no. 65, p. 11; New South Wales government, Submission no. 72, p. 12; Novartis, Submission no. 26, p. 7.

120 Novartis, Submission no. 26, p. 7.

121 CSIRO, Submission no. 56, p. 4; Victorian government, Submission no. 67, p. 3.

122 Centre for Legumes in Mediterranean Agriculture, Submission no. 14, p. 4; Dairy Research and Development Corporation, Submission no. 15, p. 5.

123 Dr Brian Booth, Submission no. 7, p. 4; Waratah Seed Co., Submission no. 23, p. 2.

5.101 The Queensland government pointed to 'the Monsanto experience' with Bt cotton where, it claimed:

... the cost is not related so much to the cost of production but on what the market will bear. This can be alleviated to a major extent through support for competitive endeavours, particularly by public programs.¹²⁴

However, public subsidy of research is diminishing and prices are expected to rise as a result.¹²⁵

5.102 Fears were expressed to the committee that, in this situation, the few multinational companies that own many of the key gene technologies would charge premium prices. In the absence of competition, costs are likely to be even higher. This appeared to be the case with Bt cotton in Australia, as described in Box 5.3.

5.103 The committee appreciates the fears of those who anticipate that multinationals will charge exorbitant prices for GMOs. It is aware, however, of suggestions from others, like CSIRO and the Australian Academy of Science, that the opportunity to exact unusually high profits will be limited, given the competitive nature of production of all commodities.¹²⁶

124 Queensland government, Submission no. 79, p. 3.

125 South Australian government, Submission no. 81, p. 12.

126 Australian Academy of Science, Submission no. 62, p. 1; CSIRO, Submission no. 56, p. 4.

Box 5.3 Ingard® cotton seed price

When Monsanto introduced Ingard® cotton in 1996, it set the price of seed at \$245 per hectare, which was considerably more than was charged for Monsanto's Bt cotton in the USA. The Ingard® price was based on the assumption that Ingard® cotton would reduce the insecticide sprays used to control *Helicoverpa spp.* by 90 per cent. However, in response to concerns raised by the cotton industry, Monsanto also included a value guarantee. The guarantee included a rebate if the Ingard® crop planted by the farmer did not provide \$245 worth of value in reduced sprays when compared with a conventional cotton crop grown on the same property.

Ingard® cotton's performance in Australia has been far less impressive than was expected. It has reduced *Helicoverpa* sprays by 40 – 50 percent, instead of the predicted 90 per cent. Dr William Blowes, a technical director at Monsanto Australia, estimated that \$2-3 million dollars was rebated to farmers through this scheme.

At the end of the second year of the scheme the cotton industry asked Monsanto to adopt a lowest possible price strategy that reflected value to most cotton growers, while allowing Monsanto a reasonable return on investment. As a result, the cost was reduced to a net purchase price of \$155 per hectare.

Ingard® cotton is not particularly profitable when compared with other technologies. Monsanto Australia does not expect to make a positive return on the technology until 2001, and Monsanto Co. USA will not recoup the development costs for biotechnology research for some considerable time after that.

Within Australia, almost all modified genes and the processes used to transfer them are patented by multinational seed companies. Many of these companies have the potential to create monopolies and produce false markets. For example, because there is currently only one supplier of GM cotton in Australia, the price of GM cotton seed may not reflect the true value of the product. However, the CRCA considered that the price of the seed will always be competitive or it will not succeed in the Australian market.

Source: Australian Biotechnology Association, Submission no. 39, p. 6; Cooperative Research Centres Association, Submission no. 40, pp. 8-9; Cotton Seed Distributors Transcript of evidence, 18 October 1999, pp. 235-6; Monsanto Australia Ltd, Submission no. 44, pp. 2-4; Transcript of evidence, 18 October 1999, p. 231.

- 5.104 One way in which the owners of gene technology recover costs from growers of GM crops is through licences. Under this arrangement, growers pay a licence fee, in addition to paying the organisation that bred and marketed the seed.¹²⁷ End point royalties (EPRs) are another avenue for recouping costs, with growers making payments to the seed supplier at the time of harvest. With EPRs, companies are more able to effectively derive ownership of varieties and the technology used to develop them. This provides:
- ... the incentive for increased investment in new varieties and technologies, orderly and structured distribution and expansion of production and more effective alignment of production to markets, with subsequent greater market share and price premiums with a flow back to the producer.¹²⁸
- 5.105 To capture EPRs, closed loop marketing licences are sometimes used. They involve exclusive seed and grain marketing rights and payment of royalties on sales of both seed and grain. Such arrangements are seen as anticompetitive, and likely to restrict marketing choices and infrastructures.¹²⁹ Issues relating to EPRs are discussed further in Chapter 6.
- 5.106 In addition to the cost of purchasing GM seed, the grower will encounter other costs associated with regulatory requirements relating to management and monitoring of the crop and, in some circumstances, the need to segregate GM from non GM produce.

Issues for small producers

- 5.107 Among the terms of reference for the inquiry is one that tasks the committee with examining the impact of gene technology on small producers. In general, the impacts on them are no different in kind from those facing all producers, although they may be felt more intensely, as would be the effect of many new technologies.
- 5.108 According to Avcare, Australia's system for IP protection gives small producers the same opportunities to capture value from their IP as large corporations or government funded institutions.¹³⁰ Even small producers could gain access to the necessary technologies through cross licensing
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127 Novartis, Submission no. 26, pp. 7-8.

128 South Australian government, Submission no. 81, p. 12.

129 Grains Council of Australia, Submission no. 65, p. 10; NSW Farmers' Association, Submission no. 38, p. 10; Victorian government, Submission no. 67, p. 2.

130 Avcare, Submission no. 61, p. 5.

arrangements or other forms of association,¹³¹ develop new varieties from varieties containing GM traits, and successfully protect them under the Plant Breeders' Rights (PBR) Act.¹³²

5.109 However, small producers do not have the resources to compete with major plant breeding companies. They have neither the financial capability nor the expertise to deal with relevant IP, regulatory and management issues.¹³³ The Dairy Research and Development Corporation considered that it is:

... increasingly unrealistic that small producers will be able to grow and supply new varieties of pasture seed (traditional or genetically enhanced) given the extent of investment in technology and infrastructure necessary to achieve a critical mass for a financially viable enterprise.¹³⁴

AgrEvo agreed with this view:

The development of GM varieties is expensive due to the global regulatory and product stewardship responsibilities that come with them. This makes it difficult to support widespread access or development of novel varieties by small players.¹³⁵

5.110 Among those who addressed the issue, there was little support for assistance targeted specifically at small producers.¹³⁶ The Victorian government pointed out that growers and both the Commonwealth and state governments already contribute to gene technology R&D. The committee is concerned about the role for small producers in the development of gene technology. An appropriate form of assistance for them would be through the incubator program.

5.111 The committee believes that small producers may be able to carry out breeding work with varieties containing GM material. The committee noted CSIRO's suggestion that 'the most effective and specific assistance to small producers and independent breeders would be educational in the

131 Cooperative Research Centre for Tropical Plant Pathology, Submission no. 21, p. 3.

132 Victorian government, Submission no. 67, p. 4.

133 Cooperative Research Centres Association, Submission no. 40, p. 9; CSIRO, Submission no. 56, p. 6; Queensland Fruit & Vegetable Growers, Submission no. 42, p. 3; Western Australian State Agricultural Biotechnology Centre, Submission no. 10, p. 2.

134 Dairy Research and Development Corporation, Submission no. 15, p. 5.

135 AgrEvo, Submission no. 55, p. 4.

136 Ag-Seed Research, Submission no. 31, p. 9; New South Wales government, Submission no. 72, p. 12; South Australian government, Submission no. 81, p. 13; Victorian government, Submission no. 67, p. 4.

form of sharing knowledge about how to position Australia and manage ... relationships' with the larger players in the field.¹³⁷

5.112 The committee identified a number of other aspects of using GM crops as being of particular significance for small producers. They are summarised in the following points.¹³⁸

- Regulatory requirements could be problematic, for example, if big buffer areas around crops were required.
- The task of segregating GM and non GM produce is likely to be more burdensome for smaller than for larger producers, as will that of dealing with liability for any untoward outcomes of growing GMOs.
- It may be more difficult for small producers to acquire sufficient knowledge about the benefits and drawbacks of GMOs to make informed decisions about their use.

Recommendation 23

5.113 **The committee recommends that Biotechnology Australia, in conjunction with other agencies, develop and deliver educational programs and materials targeted at small producers and breeders.**

These programs and materials should cover:

- **the business and intellectual property issues relating to the breeding of agricultural genetically modified organisms; and**
- **the practical aspects of using genetically modified organisms in agriculture.**

137 CSIRO, Submission no. 56, p. 6.

138 Cotton Research and Development Corporation, Submission no. 27, p. 7; CSIRO, Submission no. 56, p. 5; NSW Farmers' Association, Submission no. 38, p. 8; Western Australian government, Submission no. 48, p. 3.