Submission Document to the DEST Science Skills Audit

Definitions

For the purpose of this submission, agriculture is defined as the practice of cultivating the land or raising stock. Agricultural science today includes the disciplines of crop and pasture agronomy, horticultural science, plant and animal pathology and microbiology, weed science, agricultural and environmental engineering, soil science, food science, supply chain management, forestry, natural resource management, veterinary and animal sciences, and fisheries.

1.0 Supply of agricultural science skills from all training and education sectors and report on supply trends

1.1 High Schools

There is some concern that there is a decline in students enrolling in science subjects at high school level. However, in NSW, there is no evidence for a decline in student numbers enrolling in Agriculture, Primary Industry or Food Science subjects (Foster, L. 2004 pers. comm., Chief Education Officer, K-12 Technology, NSW Department of Education and Training). However, there seems to be some reluctance for many High School students to enrol in Agricultural degrees at the VET or University level. This could be due to the high school curriculum (eg. Primary Industry), or negative sentiments due to the drought and the poor image of farming. There is also concern that the proportion of rural-based students studying agriculture has declined, and most HSC Agricultural students who continue to undertake further university studies come from the major cities. The NSW Board of Studies has recently been debating the introduction of a Year 13, a preparation year, after the HSC to allow students to develop their critical thinking skills, core competencies, and to enrich their life and interpersonal skills. A Year 13 would allow students entering agriculture and related subjects to gain practical experience, either on the farm, or in a downstream industry, and allow seamless entry into the course of choice. A Year 13 would also allow lecturers borrowed from local industry to identify those students with innovative and entrepreneurial skills. A similar situation is thought to exist in SA where country students do subjects other than agriculture partly because agriculture teaching is so poor in schools that it attracts the lower potential students, or because farming is not seen as something attractive to enter into.

It has been suggested that professional bodies should become more involved with agriculture teachers during their training and on the job. Most teachers are now recruited from the cities where students have limited opportunities to gain real experience of agriculture and all its facets. The terms of appointment agriculture and science teachers need to be changed to give these people more opportunities to keep up to date during non-teaching periods. There should be improved federal and state schemes to provide this training, and these teachers need to be better supported with materials and technical assistance.

1.2 VET and Universities

The major providers of vocational education and training (VET) and higher education (Universities) nation-wide are listed on the *http://www.dpi.qld.gov.au/rerc/15542.html*, **National Training Information Service (NTIS)**, and **Education Network Australia (EdNA Online)** websites.

The VET courses are mostly at the Certificate, Diploma and Advanced Diploma level and are delivered by Registered Training Organisations (RTOs) (Good Fruit & Vegetables, Sep 2004) which include:

- Institutes of Technical and Further Education (ITAFEs) (eg. TAFE SA provides a wide range of practical courses);
- Agricultural Colleges (eg. in Queensland; Dalby, Emerald, Longreach and Aust. College of Tropical Agriculture at Burdekin, in NSW; Murrumbidgee and CB Alexander Colleges, in WA; Colleges of Agriculture at Harvey, Morowa and Denmark).
- Other government departments such as Departments of Primary Industries (eg. in Knoxfield, Victoria);
- Industry associations;
- Private training companies; and
- Community organisations

Of these RTOs, ITAFEs make up the largest number.

The higher education courses are mainly provided by the universities with some higher research degrees provided jointly by universities and CSIRO, state departments of primary industries or private industry. For undergraduate agricultural science courses, there is a trend towards the following (The Land, 4 Nov 04):

- Low entry scores for agriculture courses, reflecting a lack of demand rather than the intellectual demands of the courses themselves. The low scores tend to demean the profession's image, which in turn reduces demand. Despite the low entry scores, there are still vacancies in many agricultural courses.
- Falling student enrolments in agricultural courses leading to staff redundancies in some universities (eg. UWS Hawkesbury);
- Practical classes in agriculture (that are expensive to run) being cut back;
- Many universities facing financial difficulties are seeking to solve their problems by cutting low demand, high cost courses, selling off assets, and concentrating on courses that generate the highest net return. Agriculture courses are likely to further suffer from all such options. Education in agriculture and natural resources is resource intensive in both absolute and per head terms and is therefore often targeted when the institutions need to make cuts.
- Loss of identity of agricultural science as discrete courses. Agricultural courses have become part of a broader set of science offerings and have lost their identity and focus.
- A continuation of universities cutting back without any real efforts to establish national courses in specialised disciplines such as entomology.
- There are few agricultural courses that are specifically set up to train farmers. There is a lack of farm management training, such as might suit the future

generation of commercial farmers, and be part of the training for future consultants. The traditional agricultural colleges that provided the more practical courses are now part of the university system and in Victoria, NSW and SA at least have either been rationalised or their very existence is threatened;

- Development of three year degrees (eg. UQ Gatton) from traditional 4 year agricultural science degrees;
- Rationalisation and reduction of agricultural science subjects / units of study so that more students can be taught together in larger classes (eg. UWS Hawkesbury and USyd);
- Introduction of specialised degrees (eg. B. of Horticultural Sc. & Land & Water Sc in USyd, B. of Equine Studies at UWS Hawkesbury, Aquaculture at Charles Darwin University) to cater for specialist industries;
- Cross-disciplinary course development.

2.0 Public and private sector demand for agricultural science skills from industry, the research community and education providers, both now and into the future

The public sector demand for agricultural science graduates is mainly from universities, CSIRO and state departments of primary industries, forestry and national parks. Private sector demand for agricultural science graduates is mainly from the agricultural consultants, rural fertiliser & seed suppliers (eg. AWB Landmark), supply chain providers (eg. Australian Wheat Board, wholesalers, large retailers, transport companies), rural industries, farms, food processing companies, cropping, livestock and pastoral companies.

2.1 Public sector demand

In the past, the state departments of primary industries, forestry and national parks used to be a large employer, taking in many agricultural science graduates. However, in recent years, due to downsizing and rationalisation, they are taking in fewer and fewer graduates. The state departments of primary industries were traditionally sources of finishing training where young graduates were mentored in the field by experienced scientists. This was a source of trained staff for the departments, agribusiness and consultants. That has now gone and young graduates go straight into the field relatively inexperienced, and sometimes give the profession a bad name. Also, short term contracts (3 years or less) for postdoctoral research fellows, researchers and other staff provided by CSIRO, universities and state departments of primary industries on research grants do not provide a lot of incentives for new graduates since there is a lack of a clear long term career path.

2.2 Private sector demand

Fortunately, private agricultural consultants have increased their intake of agricultural science graduates in recent years. These consultants provide greater stability of employment and they do well as they develop real technical expertise in regional agronomy, good field and laboratory experimentation, chemical residue and environmental issue. They get to know their local districts and become experts in their

districts (Hood, M. 2003 pers. comm., agricultural consultant). Commercial food and agribusiness companies are also employing more agricultural science graduates. However, these companies need more incentives (eg. tax incentives) to conduct more research and development work.

The demand for agricultural graduates is so good at present that most graduates get employment within 1 or 2 months of graduation, and most universities have trouble attracting graduate students to conduct PhD research. The future trend is still leaning towards increased demand for agricultural science graduates from private agricultural consultants, food and agribusiness companies. However, with fewer graduates going on to do PhDs, there will be a shortage of research-trained staff in the near future. Private research companies include the Sydney Postharvest Laboratory, Applied Horticultural Research, and Agri Media (Richmond, NSW). These companies do not necessarily feel the need to employ PhD graduates because many PhD graduates are thought to be 'too academic' with not enough hands on and down to earth skills. Very few private laboratories require molecular biologists, although this is a fashionable area for students, and many universities encourage agricultural students to specialise in molecular biology.

3.0 Success of the education sectors in meeting existing agricultural science skill needs and responding to emerging needs

In the past, the education sectors have been quite successful in meeting existing agricultural science skill needs. However, in recent times, there is a shortage of suitably qualified graduates to fill vacancies in the consulting, research and agribusiness industries. Some of the reasons for this are as follows:

- Lag time to supply graduates for fast growing industries – the wine industry is an example of a fast growing export industry that had a lack of graduates trained in vineyard management and wine making for many years – it was not until CSU and UniSA established new courses with funding from the Grape and Wine Research Development Corporation that enough graduates could be provided for this industry. The main reason for increased student interest in viticulture was the fact that the industry boomed which increased demand, and was seen as a glamour industry by students.

- Emerging industries – new industries such as aquaculture are now emerging with ocean fish stocks being depleted and over-harvested. There are a few universities such as Charles Darwin University and University of Tasmania that have set up new aquaculture courses but it may take a few years before suitable graduates can be produced.

- Agricultural faculties have become molecular science faculties – there is an increasing trend for many agricultural faculties to focus strongly on fundamental aspects of science such as molecular biology research (due to available funding) at the expense of research and teaching in the fundamental courses on plant

(crop/pasture) and animal physiology and farm management. Hence, many graduates are molecular scientists without suitable training in agronomy or animal husbandry. **Many agricultural consultants have been disappointed at the lack of suitably trained graduates especially in agronomy and plant breeding.**

- Emerging technologies – new and emerging technologies such as biotechnology, gene technology and precision agriculture require specialist teachers and researchers to train graduates. These specialist teachers are in short supply in many universities.

- Changing technologies – technologies such as information technology (internet etc,) are advancing so quickly that certain "trades" that some graduates are trained in become obsolete in a few years. Universities may have to focus on training graduates in critical thinking, problem solving and life long learning skills rather than just discipline content, to help graduates adapt to the ever changing technologies. The ability to handle change, and to analyse and synthesise information, and integrate the disciplines is essential for field agriculture. "The ability to manage change is the greatest challenge facing small businesses today. Change is making things different: the drivers of change in any environment being, the nature of the work force, new and upcoming technology, economic shocks, social trends, world politics and competition" (Murrell 2002 – *National Institute of Accountants Jnl* Vol **19**(3) Jun/Jul).

- Undergraduate students are avoiding agricultural science courses due to the perceived negative image of farming, bad news about the drought and population decline in rural Australia. The low starting pay and short term (3-year) contracts (in the public sector) also do not make this profession very attractive. Some of the recent demand has come from the Natural Heritage Trust (NHT) and other programs, which are not likely to be sustained in the long term. Many students prefer to do law, medical science and information technology (or even forensic science), and ignore the fact that they can still easily get employment in agriculture when they graduate. There has been a tendency for those involved in agriculture to write the industry down. More must be done to overcome the negative image of farming!

- The future directions for agricultural education must be driven by thorough understanding of the <u>demands</u> of the various sectors of the industry (rather than the traditional supply driven approach). It requires an independent review which is based in competent research and considers all options, including rationalisation of the agriculture education delivery sector. It should include all education providers in what is a comprehensive "horses for courses" approach.

4.0 Global demand for agricultural science skills (brain gain, brain drain issue)

In the late 20th Century, migrations of highly skilled farm entrepreneurs from South Africa into Australia (and around the world) during its period of international marginalisation was possibly beneficial to the Australian knowledge economy. However,

with one of the highest personal tax structures among the OECD countries, Australia may now be losing some of her best agricultural scientists. Australian agricultural scientists tend to do well overseas as they are generally not as specialised as their overseas counterparts and are more adaptable to different areas. It may not be so bad for Australian scientists to work overseas as long as they return and bring back their technical and management skills with them. There are schemes such as Federation Fellowships to help bring back our best scientists.

Better funding needs to be available at the postgraduate and postdoctoral phase, to attract and retain our best scientists in Australia. Employment opportunities in the agricultural fields in academia are generally declining because universities are functioning as education businesses. Courses not drawing enough students cannot afford the staff numbers. Hence, staff are lost, research output is reduced, and the quality of the graduate declines. The current payment is about $24,000/ EFTSU (Equivalent full-time student unit – 1 EFTSU represents the standard load for a full-time student for 1 year) maximum or about $3000/unit containing 8 units/year. However, not all units are paid at this rate because they are drawn from other disciplines. To meet the demand for agricultural graduates, DEST should consider increasing the payments per EFTSU for agricultural courses.

Most agricultural researchers in universities, CSIRO and state departments of primary industries would have research projects funded through Research and Development funding bodies (eg. Horticulture Australia and Grains Research and Development Corporation), that would receive funds from Commonwealth and industry funds. Commonwealth levies are introduced after consultation with producers, to fund important industry and public interest projects, and to address areas where there is a significant market failure, and/or a major health or environmental risk. The Commonwealth currently contributes to the research component of levies collected in accordance with an agreed ratio: ie, The Vegetable Research Levy; Commonwealth contribution = one dollar for each producer dollar; Forest and Wood Products Levy = One dollar for each four dollars collected. If the Commonwealth can increase its contribution to Research and Development (eg. fund 2 for 1 instead of 1 for 1), this will provide more certainty and continuity of employment of Australian academics, researchers and scientists.

5.0 Recommendations

1. Conduct a major national review of agricultural education to study the supply and demand for University and VET agricultural science courses in Australia with a focus on industry needs.

2. Improve the agricultural science curriculum and train better teachers so that our young can be educated in agricultural science from Kindergarten to Year 12, and be encouraged to continue with higher education in agricultural science.

3. Provide more funds and for mentoring programs, rural scholarships and training in farm management for farmers, farm managers and agribusiness companies.

4. Provide agricultural courses that train students in critical thinking, problem solving, handling change and life long learning skills to help them adapt to the ever changing technologies. For example, practical training as used to be provided by the departments of primary industry is critical.

5. Provide programs and positive publicity to promote the successes of agricultural industries and overcome the negative images of farming.

6. Provide more stable career paths for agricultural scientists with longer tenures.

7. Better coordination and consolidation of research, extension and technology adoption activities in Australia. There should be improvements made to communicate research outcomes to all stakeholders. The Commonwealth's quasi-public research sector should develop a closer interface with the agribusiness. This interface is the key to "bringing to market" (commercialising) the knowledge and technology developed by Australia's scientists and researchers (GRDC 2002 – GRDC submission to an 11 Nov 2002 inquiry into business commitment to Research and Development in Australia).

8. Provide better incentives (eg. tax incentives) for public and private companies to invest in training, research and development.

9. Provide better incentives for overseas Australian scientists to work in Australia.

10. Increase the Commonwealth contribution to Research and Development (Commonwealth Levies), and increase the payments per EFTSU for agricultural degree courses to retain and attract more scientists and world-class researchers to work in Australia.

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