Submission No 90

Review of Australia's Relationship with the Countries of Africa

Organisation: CSIRO – Answers to Questions on Notice

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Questions on Notice

Joint Standing Committee On Foreign Affairs,Defence And Trade

Australia's relationship with the countries of Africa

Wednesday, 5 May 2010

Members: Senator Forshaw (*Chair*), Mr Hawker (*Deputy Chair*), Senators Mark Bishop, Ferguson, Fifield, Furner, Hanson-Young, Johnston, Ludlam, Moore, O'Brien, Payne and Trood and Mr Baldwin, Mr Bevis, Ms Julie Bishop, Mr Coulton, Mr Danby, Ms Annette Ellis, Mr Fitzgibbon, Mr Gibbons, Ms Grierson, Mr Hale, Mrs Markus, Mr Murphy, Mr Oakeshott, Ms Parke, Ms Rea, Mr Ripoll, Mr Robert, Mr Ruddock, Ms Saffin, Mr Bruce Scott and Ms Vamvakinou

Members in attendance: Senators Mark Bishop, Forshaw and Moore and Mr Danby, Mr Fitzgibbon, Ms Grierson, Mr Hawker and Mr Murphy

Terms of reference for the inquiry:
To inquire into and report on:
Australia's relationship with Africa, with special emphasis on:
• bilateral relations at the parliamentary and government levels;
• economic issues, including trade and investment;
• cultural, scientific and educational relations and exchanges;
• development assistance co-operation and capacity building;
• defence cooperation, regional security and strategic issues; and
• migration and human rights issues.
The Committee will consider both the current situation and opportunities for the future.

CSIRO Delegates
CARBERRY, Dr Peter Stanley, Deputy Director, Sustainable Agriculture Flagship
KEATING, Dr Brian Anthony, Director, Sustainable Agriculture Flagship

Question on notice no. 1

Further information was requested by Hon J Fitzgibbon in relation to the specific work conducted by CSIRO in Africa. In particular, he requested up to a dozen case studies identifying the impact of previous research completed on the African continent.

FITZGIBBON….On page 6 of your submission you say:

Since 2007, CSIRO has partnered African researchers in training local change agents …

To me that is very, very interesting, but we do not get a feel for who exactly these change agents are, what they are doing, where they are et cetera. If you could just give us some case studies on notice that might give us a better picture of exactly what effect your work is having on the ground

Dr Keating—A point I would like to make here is that one activity tends to build on another. Some of our successes in, say, southern Africa were strongly built on the experience we built up in eastern Africa five or 10 years earlier. So we can perhaps draw out a series of case studies that show the links over time—how one piece of science that started out somewhere has ended up with an opportunity to apply it somewhere else. In many cases it is then picked up by other groups and if you go back to Africa now you start seeing that some stuff you were involved in starting 20 years ago is now part of the mainstream. …..

Response

This response follows the above suggestion of Dr Keating in briefly documenting some of the CSIRO research undertaken in Africa over the past 25 years whereby activities have built on prior efforts conducted with a range of change agents. The particular research approach chosen for this purpose is as identified in the CSIRO submission (page 4) – namely, "*farming systems research which is supported by systems simulation and has provided a novel approach to allow change agents to explore their options in designing and delivering services for smallholder farmers*".

The use of crop-soil simulation models in southern and eastern Africa began in collaboration with the Kenyan Agricultural Research Institute (KARI) in 1985[1] and has continued through until 2010. From this work a number of case study examples can be elicited where participants and impacts can be identified. Importantly, the most of the following case studies were recently published in an international peer-reviewed journal as examples of this work – this response reproduces edited text from the 2009 paper[2] by Anthony Whitbread and others.

Case 1. Farmer involvement in research in Kenya

As a consequence of the initial CSIRO project in Kenya[1], the case of a smallholder farmer who was involved in the project has been well documented[3]. This farmer succeeded in transforming his farm from one that provided inadequate food supply for his family to one on which a food surplus is regularly produced. This transformation was achieved by judicious use of organic and inorganic fertilizers. Impetus for this beneficial change in farming practice was provided through the application of a simulation model to demonstrating the production and

[1] McCown R L, Keating B A, Probert M E, Jones R K, 1992. Strategies for sustainable crop production in semi-arid Africa. Outlook on Agriculture 21:21-31

[2] Whitbread, A.M.., Robertson, M.J., Carberry P.S. and Dimes J.P., 2010. How farming systems simulation can aid the development of more sustainable smallholder farming systems in southern Africa. European Journal of Agronomy, 32:51-58.

risk consequences of alternative management practices such as fertilizer applications. This success on one farm was extended at that time to a further 106 farms in the Machakos district of Kenya via a local self-help farmer group.

Case 2. On-farm experimentation in Malawi and Zimbabwe

CSIRO activities in Malawi and Zimbabwe during 2000-2004 focussed on experimentation with various legume/fertiliser practices to restore soil fertility in highly resource-constrained smallholder farmer systems. The farming practices assessed included: the response of maize to low N-fertiliser application rates; the potential use of leguminous cash crops (soybean, cowpea) in the place of maize; green manure (mucuna, pigeon pea) legumes in rotation with maize. Each of these practices was tested with farmers in extensive on-farm experimental programs and the computer model APSIM was used to simulate the field results and build an understanding of the key drivers of the system. Some practices, especially the low application rates of fertilizer N to maize, have since been adopted by local change agents (combinations of international and local RDE agencies, NGOs and private sector suppliers) in their support to resource poor farmers. Today much of the agricultural development efforts targeted at smallholder farmers in Malawi and Zimbabwe are based on these initial research findings.

Case 3. Scenario exploration with farmers in Zimbabwe

In 2001, teams of researchers, extension officers and local participants worked with farmers in six villages in the Tsholotsho and Zimuto districts, Zimbabwe. They used participatory tools to build realistic farm scenarios for the computer simulations, which were then run for the farmers to get their reactions and suggestions for improvements. A subsequent report[4] recorded that *"…it was a surprise that computer simulation was apparently relevant to smallholder farmers in Zimbabwe."Relevant evidence included: the ready participation of farmers in specifying questions for simulation; in volunteering likely outcomes; in rationalising their expectations with simulated outputs; and in re-specifying the question for the next simulation run. The farmers in this engagement were not passive participants; rather they acted as experts in their own domain, using the simulator to explore possible consequences of altered management".* Following on from this interaction between researchers and farmers at Tsholotsho, the practices of 35 farmers in the local villages were supported over the following three seasons whereby large maize yield gains were attained from low doses of fertiliser (as little as 10 kg N/ha).

Case 4. Informing aid organisations in Zimbabwe

Over 160,000 smallholder farmers in Zimbabwe achieved 30–50% yield increases in their maize crops due to the aid-sponsored distribution of seed and fertiliser in the 2003–04 season. Most of these farmers were in the drier regions of Zimbabwe, where previous RDE efforts by international and local extension agencies had not included fertiliser. This initiative resulted in a short-term economic benefit for this large group of smallholder farmers in that particular season. This effort was to continue in the 2004–2005 season but was hampered by Government intervention. It is reasonable to predict a proportion of participating farmers would realise the benefits of applied N fertiliser and adopt this practice without subsidy. If so, the result would lead to economic, social and environmental benefits within these communities. Unfortunately this proposition could not be tested due to the political circumstances in Zimbabwe over recent years. Key architects of the 2003 aid program readily attribute systems modelling led by Australian researchers as being one source which supported the proposition of small doses of inorganic fertiliser applied in the lower potential regions of Zimbabwe. Consequently, modelling has become a core component within several follow-on projects in the region.

Case 5. Involving the private sector in South Africa

Between 2004-1008, CSIRO researchers worked with local and international researchers in southern Africa in successfully attracting the support of the private sector in improving the access and affordability of fertiliser for farmers. The research demonstrated to these

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[3] Lee, B. 1993. Escaping from hunger: research to help farmers in semi-arid Kenya to grow enough food. ACIAR Monograph No. 23, 52p

[4] Carberry, P., Gladwin, C., Twomlow, S., 2004. Linking simulation modelling to participatory research in smallholder farming systems. In: Delve, R.J., Probert, M.E., (Eds.), Modelling Nutrient Management in Tropical Cropping Systems. ACIAR Proceedings No. 114, Canberra, Australia, pp. 32–46

companies that the cropping risks faced by smallholder farmers did not negate the opportunities for investing in fertilizer and seeds. Consequently, Sasol Nitro, a fertiliser company, agreed to register and supply 10, 20 and 50 kg packs of starter and topdress fertiliser to Progress Milling for distribution to the company's community-based depots. In addition, Panaar Seeds provided small packs of open-pollinated varieties (OPV) and hybrid maize and sorghum. From average fertiliser sales of around 17 tonnes per year in the previous 5 years, the initiative resulted in depot sales of 96 and 140 tonnes in 2005/06 and 2006/07. The tonnage of small packs sold in the two seasons was 20 and 22% of the season totals. By involving a fertiliser company directly in the supply of small packs, the cost premium per unit of N in previously retailed small packs was reduced from over 100% to just 10%. Surveys of farmers accessing the depots showed that small packs of fertilizer are preferred by farmers using fertilizer for the first time.

Case 6. Support for the emerging farmer sector in South Africa

In South Africa, the post-apartheid land reform policies of land restitution and redistribution have created opportunities for the previously disadvantaged black African population to own and farm land. These new farmers, joined by farmers from the subsistence sector who are attempting to commercialise, now make up a third middle sector and are considered to be 'emerging farmers'. In a CSIRO-led project conducted in the Limpopo Province between 2005-2010, the limited knowledge base farmers and extension officers had about managing commercial farms was quickly identified as a key constraint, so capacity building became the focus.

In grazing industries, over 70 farmers and 20 extension staff participated in several multi-day training courses and follow-up workshops. The development and distribution of appropriate extension material, training course material and a farm model which could be used to compare farm system improvement strategies became part of these capacity building efforts. These efforts have resulted in at least 20 land reform farmers implementing changes such as reduced stocking rates, rotational grazing and better herd management and marketing. This is evidence that on-going efforts to build capacity in local extension staff and farmers and introduce practical and low risk technologies can be successful.

With cropping farmers, a key outcome of this work was to demonstrate that more that 50 resource poor farmers were able to transform low-productivity maize-based farming systems into more-profitable enterprises by incorporating grain legume cash crops into rotations with maize and adopting simple agronomic practices. Many of these farmers can now package, store and sell high-value legume products when, just three years earlier they were barely at subsistence levels of food production. Other notable success of the crop-based work included the development of guarbean as a potential industrial cash crop (seed multiplication, variety evaluations, harvesting, processing and market development), identification, testing and the multiplication of 5 short season multi-purpose lablab lines for use as forage in rotation with maize and promotion of well adapted and high value cowpea lines.

Case 7. Development of systems modelling applied internationally

The APSIM systems model[5] is an internationally renowned computer simulation model of land use systems and their management. In relation to Africa, APSIM's genesis can be explicitly traced to the CSIRO research project undertaken in Kenya in 1985. It was within this Kenyan project that our need for systems modelling was recognised and the initial models developed. Today, a significant proportion of CSIRO's research and of the agricultural research conducted in Australia relies on the APSIM software – for example, one in five papers presented at the 2008 Australian Agronomy Conference used APSIM as an analysis approach. APSIM has become a standard for agricultural simulation software in Australia, if not the world. The development of APSIM represents a significant science impact from CSIRO's involvement in its research projects conducted in Africa and elsewhere.

[5] www.apsim.info

Question on notice no.2

The Hon. David Hawker sought clarification in regards to the number of personnel and the amount of funds attributed to our activities in Africa.

Mr HAWKER—I just want to follow up on something Mr Fitzgibbon was asking. I was wondering whether you could actually quantify the extent of your involvement in Africa. These projects look very good, but in terms of people and dollars can you at least give us a reasonable picture of that. You might want to take that on notice.

Response

It is difficult to collate the full retrospective budget for CSIRO involvement in Africa across all past activities. However, the work referenced in our response to "Question on notice no. 1" regarding CSIRO's farming systems research undertaken in Africa over the past 25 years can be given as an indication of this effort. This collective work resulted from the research and development undertaken in 7 projects conducted over this time period. Most of these projects were funded by ACIAR and they had an aggregate budget of approximately $8M. The largest project[6] was conducted in Kenya between 1988 and 1993 and was funded with a budget of $2.7M. A roll call of CSIRO researchers who worked on these projects over the past 25 years amounted to at least 17 scientists and technicians. Of course, there were many more participants in these projects representing farmers, local research and extension officers and international researchers.

Question on notice no.3

The Hon. John Murphy requested further information regarding the aquaculture research undertaken in Africa.

Mr MURPHY—I congratulate the CSIRO for what you are doing in Africa in terms of foodsecurity. I draw your attention to page 6 of your submission, under the heading 'Food security in coastal Africa from aquaculture' where you say, inter alia:

CSIRO Food Futures Flagship developments in aquaculture offer food security and export market creation opportunities for tropical and sub-tropical coastal Africa. They provide the opportunity to produce healthy seafood grown in droughtproof environments using ecologically sustainable systems sensitive to climate change.

I would like to give you the opportunity to tell the committee of CSIRO's successes in that field.

Dr Keating—You have picked the one area in the submission that we are not as well versed in as in others. We are not experienced in the aquaculture area. I can respond in general terms. My understanding is that the Food Futures Flagship have been working on land based aquafeeds as an alternative to sea based feeds, which are an unsustainable resource. They are also working on enhancing the quality of land based feeds—legume based materials, grain base materials—so that they are suitable as an aquafeed. It involves manipulating the protein and amino acid composition of those feeds to make them suitable for aquaculture feeds. My understanding is that this is the work that is referred to here.

[6] http://aciar.gov.au/project/LWR2/1987/035

Response

Coastal areas of East Africa are home to more than 30 million of the poorest people in the region. These communities have traditionally depended on wild harvest fish as their principal source of protein and income. The dual impacts of overfishing and rising populations have generated an urgent need to find alternative sources of food and income to prevent the escalation of poverty in these coastal communities, which is already at the highest level in East Africa (e.g. 62%-63% in Kenya: 2000 national statistics). In partnership with ACIAR and the Vietnamese government, CSIRO has previously developed aquaculture techniques that have sustainably increased the income of thousands of coastal rice-shrimp farmers in the Mekong Delta. The CSIRO Food Futures Flagship has recently established an R&D engagement and delivery mechanism with coastal communities and NGOs in Kenya and Tanzania. CSIRO is now exploring funding opportunities to introduce CSIRO knowledge and technologies to the region. These have great potential to transform the food security, health and wealth of the region whilst also conserving the marine ecosystems that are increasingly under threat.

Follow up questions

Improved Varieties

1. Your submission advises (p. 5) that CSIRO is currently undertaking research with partners in sub-Saharan Africa into developing genetically modified cowpeas with built-in resistance to pod borers.

    - What is the level of acceptance of GM crops in Africa?
    - Are you undertaking any other GM work with application to Africa?

Response

What is the level of acceptance of GM crops in Africa?

GM crops have been released on a commercial scale in South Africa, Egypt, and Burkina Faso. Several other countries are preparing for releases as well but must first get the Biosafety Bills through Parliament. Examples here include Nigeria, Kenya, Uganda and Ghana. The level of acceptance of GM crops in Africa varies widely across the community but the following is generally applicable:

1) Public knowledge and understanding of biotechnology remains relatively low
2) Consumers know little about the extent to which their foods include genetically modified ingredients
3) While support for GM foods has been stable, opposition has softened and opinions on safety remain split
4) Animal cloning evinces much stronger opposition than does modifications of plants
5) Consumers look to those closest to them – especially friends and loved ones – as trusted sources of information on GM foods and biotechnology

A survey carried out in Kenya[7] shows that most people believe in the technology's potential positive impacts, with more than 80% agreeing that it can offer a solution to the world food problem, 79% that it can reduce pesticides in food, and 73% that it has potential of reducing pesticide residues in the environment. However, a large number of consumers expressed concerns about potential negative effects. About half of the respondents think that insect resistant GM crops may kill non-target insects and that the technology could lead to a loss of local varieties. More than one-third of the consumers expressed fears about the health effects of GM foods, think that people could suffer allergic reactions after consuming GM foods (40%), and think that consumption could lead to an increase in resistance to antibiotics (35%). Half of the people think that GM food is artificial and that GM represents tampering with nature. Only 23% think that producers of GM foods are "playing God." On equity issues, the Kenyan consumer clearly disagreed that GM crops are biased to large-scale farmers and multinationals. A majority (71%) disagreed with the statement that GM products do not benefit small-scale farmers. Less than one-third (30%) think that GM products only benefit multinationals while 65% disagree. Only one-third (36%) think that GM products are being forced on developing countries, with a majority (54%) disagreeing.

Are you undertaking any other GM work with application to Africa?

None are specifically aimed at Africa at present but several could have application there. For example, long chain omega 3 oils in crops such as groundnut could be of great health benefit.

[7] Simon Chege Kimenju, Hugo De Groote, Joseph Karugia, Stephen Mbogoh and David Poland. Consumer awareness and attitudes toward GM foods in Kenya. IRMA Socioeconomics Working Paper 2004-01

During the hearing (Transcript p. 36) the Committee raised the issue of an ABC *Four Corners* report which alleged large multinational companies were 'mining' Third World countries for their genetic diversity, and through a subsequent patenting of genes preventing access to genetic information, especially genes that confer drought resistance.

2. Dr Keating commented that he had 'never seen any specific evidence of a particular problem.'
    - Upon reflection, are you able to add anything further?
    - Are such concerns regarding genetic mining valid?

Response

As stated during the hearing, and tested with other colleagues since, CSIRO can not report of any specific knowledge or evidence of so-called mining of genetic resources from Third World countries. In contrast, in our formal submission and subsequent hearing, we have pointed towards examples where African countries are benefiting from international partnerships in agricultural RDE, such as in the development of cowpea varieties with built-in resistance to pests.

In a recent paper[8], CSIRO identified the specific issue of intellectual property (IP) protection and its transparency as a challenge in Third World countries, as many do not have a patent system that supports innovation. This paper points to some developments where international consortia are trying to improve this situation.

3. Dr Carberry referred (Transcript p. 36) to a number of life science companies being involved in partnerships with the international research community regarding making some of their genetic discoveries available to smallholder farmers.
    - Would you provide more specific information?

Response

The transcript referred to the Crawford Fund's 15th Annual International Conference (27–28 October 2009) which addressed the topic of "World food security – can private sector R&D feed the poor?" The full proceedings can be found at www.crawfordfund.org/assets/files/conference/proceedings/Crawford_Fund_2009_Conference_Proceedings.pdf. The full proceedings have a number of examples of public-private partnerships.

The paper by Thomas Lumpkin (CIMMYT) and Janice Armstrong (Monsanto) entitled "Staple Crops, Smallholder Farmers and Multinationals: The 'Water-Efficient Maize for Africa' Project" (page 50) is specifically recommended. The paper provides the example of "the Water-Efficient Maize for Africa (WEMA) project, a five-year public–private partnership begun in 2008 and led by the African Agricultural Technology Foundation (AATF) … Under WEMA, Monsanto, the International Maize and Wheat Improvement Center (CIMMYT), and national agricultural research systems in Kenya, Mozambique, South Africa, Tanzania and Uganda are developing, testing and disseminating drought-tolerant maize. Efforts involve both advanced, conventional breeding techniques and biotechnology tools. Transgenic drought tolerance from Monsanto and BASF is being added to elite, drought-tolerant maize lines from CIMMYT and Monsanto so that the new varieties will better withstand the increasing impacts of climate change in Africa. WEMA varieties under development have been licensed to AATF for eventual use by local, qualified seed producers and made available to them royalty-free".

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[8] Joanne Daly and Jeremy Burdon. 2009. Private-Sector Investment in Australian and International Agriculture. Crawford Fund's 15th Annual International Conference (27–28 October 2009). www.crawfordfund.org/assets/files/conference/proceedings/Crawford_Fund_2009_Conference_Proceedings.pdf

4. Your submission provides (p. 7) information about your work in Africa to increase the genetic base of the Australian Silky Oak—a species commonly grown in Africa.

   - Are there other Australian tree species, for example acacias and Australian rainforest species, which could be used for timber production in Africa?
   - Developing African trees is more ecologically sound—why use Australian trees?
   - Is CSIRO undertaking work on African tree species?

Response

Are there any other Australian tree species, for example acacias and Australian rainforest trees, which could be used for timber production in Africa?

Yes, in fact Australian Eucalyptus and Acacia species are widely grown in the majority of African countries. They are grown both as individual trees or small woodlots by smallholder farmers, and in large plantations, and they provide fuelwood, informal building materials such as poles, and industrial wood for sawn timber and paper production. The extent of *Eucalyptus* plantings in Africa (over 1.5 million hectares in total) can be seen at the following web link http://git-forestry.com/download_git_eucalyptus_map.htm.

There are hundreds of thousands of hectares of plantings of Australian *Acacia* species – for example *Acacia mearnsii* in South Africa and *Acacia saligna* in Ethiopia and other countries in northern Africa. In some regions such as parts of South Africa, these Australian acacia species, which were first introduced in the 19th century, have spread as weeds. CSIRO assisted many African research agencies with the scientific introduction of better genetic bases of important Australian species during the 1980s and 1990s, through development assistance programs funded by AusAID and ACIAR.

Developing African trees is more ecologically sound – why use Australian trees?

Grevillea robusta was taken up spontaneously by smallholder farmers in the central and east African highlands in the mid-20th century because this species, which was first introduced during colonial times to provide high shade for tea and coffee plantations, proved to be extremely valuable in agroforestry systems on smallholder farms in this region. It grows quite rapidly and produces valuable products (leaf mulch, firewood, poles and sawlogs) and is also less competitive with adjacent food crops, compared with other local and introduced tree species. This low competitiveness was studied by the International Centre for Research in Agroforestry (ICRAF) in the 1980s and 1990s and was partly attributed to the deep rooting system of the species, which is also easy to prune so that its competitive influence is reduced. During the 1990s, CSIRO helped ICRAF and other research agencies in Africa to broaden the genetic base of *Grevillea robusta* through scientific introduction and testing of a broad genetic base of the natural populations and the development of seed orchards to yield superior planting stock for African farmers.

Eucalypts are widely grown in Africa because of their ability to grow rapidly in challenging soil and climate conditions (infertile soils and long dry seasons) and produce valuable products for subsistence use and income generation.

Regardless of whether tree species are introduced or exotic, good management is critical for the sustainability of forest plantations and to ensure that adverse impacts are minimised or eliminated. With any fast-growing tree species, there is a need to plan plantations carefully at the landscape level so that regional water yields are not affected. Planning regulations limit the area that can be planted to eucalypts and other forest plantation species in South Africa, for example. Sustainable management of plantations, with attention to appropriate harvesting and replanting techniques that protect soils from erosion and husband soil nutrients and soil carbon, is also important. CSIRO has assisted tropical countries, including two African countries, to develop an international network of field trials supported by the Centre for

International Forest Research that is researching and demonstrating best practice for sustainable plantation management.

Is CSIRO undertaking work on African tree species?

CSIRO has conducted relatively little work directly on African tree species as the opportunities for such work have been limited. CSIRO scientists have acted, and continue to act, as advisers to African research agencies and international agencies such as ICRAF that implement active research programs on the domestication, silviculture and utilization of African trees species

Adapting to Climate Change

5. Your submission advises (p. 6) that CSIRO has collaborated with researchers in South Africa on research funded by the South African Water Research Commission to improve irrigation practices of small holder farmers in South Africa by designing and producing a commercial product—the Wetting Front Detector.

    - Would you provide more information on this project?

Response

This project started in 2000 as a collaboration between CSIRO and the University of Pretoria. Our aim was to build simple tools that connected the world view of the farmers and that of the scientists in a way that allowed both parties to learn from each other. We developed a 'wetting front detector' which is a simple mechanical instrument that shows how deep water penetrates into the soil after irrigation (see www.fullstop.com.au).

The wetting front detector is also used for salt and nutrient monitoring, which are generally poorly managed in irrigated agriculture. For example, 1.5 million ha of irrigated land are 'lost' to salt each year, and in the last 40 years when global food production doubled, the use of nitrogen fertiliser increased seven times. Our work has shown that much of this nitrogen fertiliser can be wasted.

The South African wetting front detector project was awarded the International Prize for Water Conservation in Agriculture (award by the International Commission for Irrigation and Drainage in Montpellier France in 2003).

The South Africa Water Research Commission continued to fund our research through until 2009. In 2010 Richard Stirzaker (developer) will join the University of Pretoria for five months to help a number of African PhD students to complete their studies on the various applications of the wetting front detector to local issues.

After exhaustive attempts to commercialise the device in Australia failed, CSIRO licensed the IP to a South African company, Agriplas. Since 2004 over 14000 wetting front detectors have been sold, with distributors in seven countries around the world.