Australian Government

# AUSTRALIA'S CHIEF SCIENTIST
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# THE ROLE OF SCIENCE IN SUSTAINABLE AGRICULTURE

## 30 MINUTES INCLUDING Q&A

## CANBERRA

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# *** CHECK DELIVERY***

Good morning and thank you for inviting me to be here.

You will be pleased to know that CropLife has a daily presence in my office, thanks to a strange looking water filter one of my researchers keeps on her desk, so your marketing team seems to have got it right.

But for now, I have been asked to discuss the role of science in sustainable agriculture.

Science's contribution to revolutionising agriculture will be of no surprise to anybody in this room. In particular, chemistry, biology and genetics have allowed us to produce more and more, with less and less.

Historically, the results have been spectacular. Since the introduction of the green revolution crops alone, global crop production has increased from 1.84 billion tonnes in 1960 to 4.38 billion tonnes in 2007. This is a 138%

increase, stemming from only an 11% increase on the amount of agricultural land used[1].

But with the boom came significant costs – including topsoil depletion, groundwater contamination, the decline of family farms, increasing costs of production, and in some places, the disintegration of economic and social conditions in rural communities.

And now we add to these unprecedented global challenges – climate change, an estimated 925 million people starving, and an ageing farming workforce[2].

On top of these, the world's population is predicted to increase to 9.2 billion by 2050, requiring an increase in global food production of 70 per cent[3].

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1 PMSEIC, 2010. *Australia and Food Security in A Changing World*. Canberra, Australia: p 21

2 World Hunger Education Service, 2012. *2012 World Hunger and Poverty Facts and Statistics*. Available: http://www.worldhunger.org/articles/Learn/world%20hunger%20facts%202002.htm

3 Croplife, 2012. *Submission in Response to National Food Plan Green Paper*. Introduction, paragraph 4. Available:

Providing enough food in this context will be an unprecedented scientific, economic and political challenge.

So today we look towards a new era for agriculture – one focused on longevity, on endurance, on sustainability.

To be sustainable we need to grow our food in ways that are less resource intensive, while still satisfying the demands of an expanding global population. Again, we need to find ways to produce more, with less.

Science will continue to be crucial in this endeavour.

This has been recognised at the most prominent, national level. Much of what we know on this topic stems from a

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http://www.croplifeaustralia.org.au/files/newsinfo/submissions/2012/CropLife%20Submission-National%20Food%20Plan.pdf

report compiled by the Prime Minister's Science, Engineering and Innovation Council, or PMSEIC[4].

The report outlined four new challenges that need to be addressed in order for Australia to move towards sustainable practices:

- Maintaining the quality of our land, water and biological resources.
- Ensuring threats to biosecurity are addressed.
- Adapting to climate change, and
- Dealing with increases in input costs.

Science underpins the responses to all of these challenges.

As an example, the quality of our land and water resources is dependent on our understanding of chemistry

4 PMSEIC, 2010. *Australia and Food Security in A Changing World*. Canberra, Australia.

and biology.

Australian researchers are already investigating new ways to improve our resource management practices.

Only a few months ago I spoke at the University of Sydney's Soil Security symposium, a relatively new area of research focused specifically on managing soil to support agricultural ecosystems.

Similarly, crop protection and biotechnology solutions are finding ways to increase yield while reducing water consumption and increasing a crop's nutrient uptake.

Another challenge, the relentless threat of pests and disease, is already being countered by science. Herbicides, insecticides and fungicides are currently relied

upon to increase global food production by between 30 and 50 per cent[5].

Finally, facing the certainty of changes to our climate, even if we do not know the extent of them, is already a huge part of scientific research.

Specifically, the CSIRO's Flagship for Sustainable Agriculture is working towards a 50 per cent net reduction in greenhouse gas emissions per unit of production from Australian landscapes by 2030.

Regardless of their success, we are faced with the reality that many current farming processes and crops will be at risk in the face of climate change.

As farmers begin to adjust, investment in climate-

5 Croplife, 2012. *Submission in Response to National Food Plan Green Paper*. Introduction, paragraph 5. Available: http://www.croplifeaustralia.org.au/files/newsinfo/submissions/2012/CropLife%20Submission-National%20Food%20Plan.pdf

dependent agricultural assets such as irrigation infrastructure, vineyards and agroforestry will become more problematic[6].

In response, GM crops are currently being developed which are tolerant to herbicides and pests. It is reported that in Argentina there has been a 216% increase in Soy bean production since the introduction of a genetically modified crop resistant to particular pests in 1996[7]. And soy is pretty important to many people in this world. From eating, to cooking oil to sauce to the upside down, skinny soy milk latte with a dash of nutmeg and/or a whiff of cinnamon.

In 10 years GM is expected to make staple cereal and tuber crops tolerant to salinity.

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6 Kingwell, Ross. 2006. Climate Change in Australia: agricultural impacts and adaptation. *Australasian Agribusiness Review*, 14, (1): p1. Available: http://www.agrifood.info/review/2006/Kingwell.pdf

7 1996: 11.2m metric tones, 2011: 48 m metric tonnes
Soy Stats, 2012. Available: http://www.soystats.com/2012/page_31.htm
WorldWatch Institute, 2012. Available: http://www.worldwatch.org/node/5442

And in 20 years, it's expected we'll have found a way to make those same crops tolerant to higher temperatures[8].

And yet even though science is crucial to the prosperity of our country (the food industry is worth $230 billion after all[9]), public funding for agricultural research has declined over the last three decades.

Investment in R&D reached a peak of five per cent in the late 1970s, as a proportion of agricultural gross value of production, but this has steadily declined to just over three per cent in 2007[10].

8 PMSEIC, 2010. *Australia and Food Security in A Changing World*. Canberra, Australia. Case Study 6, p. 48

9 PMSEIC, 2010. *Australia and Food Security in A Changing World*. Canberra, Australia p.33

10 Nossal, K and Sheng, Y. 2010. Productivity growth: Trends, drivers and opportunities for broadacre and dairy industries. *Australian Commodities*, vol. 17, no 1. ABARE, Canberra.

More worrying, the slowing in real investment in R&D has been linked to a slowing of growth in agricultural productivity[11].

There might be reasons for this. For example, there's a significant lag between R&D investment being made and a productivity gain being seen.

A recent survey found that it takes 10 years plus US$255 million to research, develop and register each new crop protection product[12] and 13 years R&D plus US$136 million to develop each new GM crop trait[13].

11 Sheng, Y., Mullen, J.D. and Zhao, S. 2010. *Has Growth in productivity in Australian broadacre agriculture slowed?* Paper presented to the Australian Agriculture and Resource Economics Society Conference, Adelaide, 10-12 February.

12 Phillips McDougall 2012, 'Trends in Industry Research and Development', April 2012 (originally in Croplife submission)

13 Phillips McDougall 2011, 'The cost and time involved in the discovery, development and authorisation of a new plant biotechnology derived trait'. A consultancy study for CropLife International, September 2011. (originally in Croplife submission)

But if we allow a long term slowing of investment growth, it's possible we'll also see reduced productivity gains for many decades to come.

Regardless of our funding situation, agricultural science is the *only* area where we have a research organisation that ranks in the top 10 in the world (CSIRO).

And in plant and animal sciences we have six organisations ranked in the world's top 10%.[14]

Furthermore, evaluations have shown that $1 invested in rural R&D returned $10.51 over the course of 25 years[15].

We have a very, very solid R&D base to build upon. And yet, not only is our funding falling, but so to are the number of people undertaking formal agricultural science

[14] PMSEIC, 2010. *Australia and Food Security in A Changing World*. Canberra, Australia, p.52 (based on Thompson Reuters Web of Knowledge, 2010)

[15] PMSEIC, 2010. *Australia and Food Security in A Changing World*. Canberra, Australia. p.16

education, *and* the number of people entering the agricultural workforce.

In Australia the average age of farmers is 53, 14 years above the national average for other occupations[16].

Some 18,000 people left the sector last year alone[17] and farmers over 55 years of age outnumber those under 35 by 4 to 1[18].

And it's not going to get better.

Only *half of one per cent* of university students takes agricultural science. In 2010 we had only 743 graduates in agricultural science. That same year, approximately 4500

16 Australian Bureau of Statistics, 2012. Labour Force and Other Characteristics of Farmers – *The Personal Characteristics of Farmers.* Available: http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/1301.0Main+Features3032012

17 National Farmers Federation, 2012. *Farm Facts 2012: Farmers are Batting Above the Average.* Available: http://www.nff.org.au/read/2527/farm-facts-2012-farmers-are-batting.html

18 Australian Bureau of Statistics, 2012. *Labour Force and Other Characteristics of Farmers* – Figure s8.2, lex analysis of graph. Available: http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/1301.0Main+Features3032012

agricultural science jobs were advertised[19].

As an interesting point of reference, China produces more than 100,000 agricultural graduates a year, compared with 700 here[20].

This is not just a supply and demand issue – Australia's aid program is to be focused on health outcomes and agriculture (food security).

Declining student participation in Agricultural Science subjects (down 31% between 2002 and 2010) and Forestry (down approx 45% since 2002 to a grand total of 53 EFTSL) impacts not just our Australian producers and economy but also our foreign policy.

Clearly, the role of science in agricultural sustainability is

19 Office of the Chief Scientist, 2012. *Senate Enquiry into Agriculture*. Available: http://www.chiefscientist.gov.au/2012/02/senate-enquiry-submission-agriculture/

20 Callick, R. 2012. Bring in Chinese farmers call. *The Australian*, August 28. Available: http://www.theaustralian.com.au/national-affairs/bring-in-chinese-farmers-call/story-fn59niix-1226456146156

only as influential as our education and workforce structures permit.

It would be naïve to think that scientific products will hold the only solutions.

A recent book took that very line, arguing that there is no need to be concerned about the future because humans will always have technology and innovation to get out of trouble[21].

And while I agree that science holds the solutions to many of our future challenges, assuming that science will always be there when we need it is incredibly risky, especially if we can't engage and inspire the younger generations to pursue science.

In order to truly move towards sustainable agriculture, we

21 Matt Ridley, 2010. The Rational Optimist. HarperCollins.

need to acknowledge that even though science underpins solutions, that science will not develop without the support of policy, of education, and of society.

For this reason, we need both ‘hard’ and ‘soft’ sciences on board. 'Hard' science will continue to tackle the challenge of doing more with less. But this needs to seen in the context of how and who it will benefit, which is the domain of the 'soft' social sciences.

It’s my understanding that the National Food Plan will attempt to do this, and I read the Croplife submission with great interest.

Australia has the expertise and skills needed to come up with new food production models. In some ways, that’s the easy bit.

But once we've done that, the real challenge identified by PMSEIC is getting our agricultural and food industries to adapt to this new production environment.

Industries need to prepare themselves for the key advances expected to come from new breeding technologies, improved resource management systems and a greater understanding of the relationship between food composition, consumption and health.

But we should be confident they can do it. We already know the food sector has a strong culture of innovation and development.

It's exposed to international markets, has a history of adapting quickly to market forces, of adopting new technology, of altering product output and production methods in response to shifting demand and environmental factors.

Sustainable agriculture *needs* science and innovation, but science needs our support.

For it’s only through recognising the importance of science, invention and technology that we can possibly hope to guarantee a truly sustainable future, for Australia, and for the rest of the world.

Thank you.