AUSTRALIAN SOCIETY OF PLANT SCIENTISTS

Submission to:

Inquiry into growing Australian agriculture to $100 billion by 2030

14th October 2019

Key recommendations:

- Support world-class Australian plant science research
- Simplify agricultural research funding
- Facilitate access to global resources to exploit plant diversity
- Reduce restrictions on growth and development of GM plants
- Promote education of agricultural scientists

$100 billion by 2030. The 2017 National Farmers' Federation's (NFF) ambitious vision is for the industry to achieve $100 billion in farm gate output by 2030. Reaching this target requires a growth rate of 3% annually, a doubling of the current trend. Indeed, with a "business as usual" approach, the current growth trajectory will only reach $84.3 billion by 2030. Furthermore, the World Bank projects a 2.7% loss in yield for Australian agriculture by 2050, due to the impact of climate change (https://climateknowledgeportal.worldbank.org).

It is unlikely that more land will become available for farming and in reality, land used for farming in Australia has declined from 500 million hectares (65% of the country's landmass) in 1973 to 406 million hectares (53% of the total landmass) in 2015. Land is also being lost due to declining soil health, increasing salinity and sodicity, erosion and acidity, and well as to the expansion of urban areas. Extreme weather events are becoming more common, as are long-term droughts and issues with water availability.

Consequently, we need to do more with less; to produce more food of higher value on the land we have available and to increase the production and value of our farm products in an environmentally sustainable manner. To achieve this, we must identify or develop higher yielding and higher value crops that can withstand Australia's increasingly adverse conditions.

The Australian Society of Plant Scientists (ASPS) is an incorporated society that promotes Plant Science in Australia and provides professional contact within our community of researchers and tertiary level teachers in the plant sciences. Members of this community make substantive contributions to research in crop and pasture plants, with the aim of increasing productivity and yield in agricultural plant species in a sustainable manner in increasingly adverse conditions.

However, under the current funding conditions, it is proving increasingly difficult to achieve our goals.

Plant Science in Australia is well-above world standard. In the 2018 review of Excellence in Research Australia (ERA) round, 17 out of the 19 of Australian Universities assessed for Plant Biology were rated 5 (well above world standard). For 13 Universities assessed for Crop and Pasture Production, 12 were rated 5 or 4 (above world standard). This is clear evidence of the quality and depth of plant science research in Australia.

Investment in plant and crop science research is extremely low. Only 15 out of a total of 654 Australian Research Council (ARC) Discovery Projects were awarded to projects in the area of plant sciences in 2018 (out of 122 in biological sciences). Despite its central role in human health and vitality, agriculture appears to be decreasingly successful at grant attainment in an increasingly competitive environment.

Funding for plant and crop sciences is highly complex and not fit for purpose. Australia currently has a complex funding environment for the agricultural sciences. Funding sources span multiple levels of government, Rural Research and Development Corporations (RDCs), direct private investment and international funding streams. The ARC and the individual RDCs have considerable influence on the nature and direction of agricultural research. The ARC dominates the fundamental end of the research spectrum, supporting inquiry into fundamental processes in plant and animal sciences but not requiring a direct extension of that research to industry. The RDCs provide a strong but not exclusive nearer-to-market focus in each of their sectors with emphasis on potential and real applications.

However, with decreasing funding from the ARC into agriculture, researchers are increasingly becoming reliant on the RDCs. This funding is short term, and unlike the ARC, is applied with deliverables and outcomes expected within the three-year life of the project. Researchers are unable to plan and carrying out long-term programmes, research that needs a continuity of staff and expertise. A short three year, deliverables focussed project cannot look far enough ahead to plant for a significant increase in farm productivity and value over the next ten years. Indeed, longer term projects are integral to study and deliver crops with traits that are integral to productivity gains in Australia; they tend to involve genetic screens and mapping of traits, which is usually a 10-year project. In addition, expertise is lost because researchers frequently drop out due to job instability and not being able to continue along a clear career path.

While we welcome the $35M in the latest ARC Centre of Excellence for Plant Success in Nature and Agriculture, the ARC must continue to invest in world class plant science research through Discovery programmes, allowing the fundamentals of plant biology to be discovered in order to have knowledge to exploit for applied research that will make real differences to agricultural output.

In summary, funding of the plant and agricultural sciences needs restructuring so that we can carry out the basic “blue sky” science that is vital for the innovation required to drive applied research and translate this to the field. This funding is critical enable crop productivity and value to increase so that $100 billion farm gate output can be achieved, on the same amount of land and with fewer resources, by 2030.

Focus of research to achieve the $100 billion ambition

1. **Introduce more genetic diversity into our crops**

    a. *reduce restrictions on access to genetic populations (landraces, wild species, genetic populations etc.) that will be used in a controlled environment setting*

Our currently-used crop species have been bred so cleanly under optimal environmental conditions that much genetic diversity has been lost. Consequently, much of the genetic traits, which would also increase resilience to pest and diseases and environmental stresses such as drought, frost, salinity, have not been selected. This makes the crop plants much more susceptible to extreme climatic events, the increasing erratic weather, and pests, diseases, drought and soil degradation associated with climate change. Furthermore, because our major crop species have all been bred under optimal nutrition, they require huge amounts of NPK fertilisers for a good yield. This is environmentally unsustainable and economically expensive. Through breeding programmes incorporating genetic populations (landraces, wild species, genetic populations etc.), we could use breeding to reintroduce these “lost” traits. However, the current regulations make it extremely difficult to gain access to such genetic material. We do understand the critical importance of Biosecurity agencies in Australia, but feel the process could be made more user-friendly with fewer delays and expense during import for ‘research-only’ purposes. This would open new avenues for international collaboration, as well as improve our capacity to develop more stress and climate and future tolerant crop varieties necessary to achieve $100 billion by 2030.

    b. *research into crops potentially more suited to Australian conditions*

Few, if any, of the crop species grown in Australia are native to Australia; most were developed from crops brought in from Europe or North America, with a few from Africa. With rising temperatures and decreasing water availability, it may be prudent to look elsewhere. To try to find and develop alternative crops and repeat the success that is being achieved in Australia with legumes. Quinoa is one example, tolerant to a huge range of stresses and it has not undergone the breeding programmes carried out for wheat, so has not lost its genetic diversity. Numerous varieties of Quinoa are available, each with their own range of preferred environment, altitude, day length, water requirement, salinity or acidity tolerance etc. Quinoa is also a high-value food with high nutritional content. Similar crops are also being exploited, but only on a very small scale. More pre-breeding research is required, and this could result in more crops that could thrive in Australian conditions and would meet the requirements of the high-value end of the market. However, again the ease of bringing imported material into Australia, while not relaxed at all, must be made more efficient.

2. GMOs and New Breeding Techniques

The emerging New Breeding Techniques (NBTs) offer novel tools for delivering desirable characteristics in crop plants. Such traits include increased yields, insect and disease resistance, heat, frost and drought tolerance as well as increasing value of a crop by, for example, increasing its nutritional quality.

There are many techniques that fall under the banner of NBTs, including those that sequence or edit genes, and so-called speed breeding and diversity breeding techniques. Some of the NBTs are relatively easy, quick and cheap to use by comparison with traditional methods and can improve the accuracy and speed of the plant breeding process.

Although many such NBTs can now be used by researchers without government approval, so long as they do not introduce new genetic material, restrictions on genetically modified organisms (GMOs) is restricting research and potential productivity increases. For example, economic analysis has shown that GM crop farmers in Western Australia, Victoria, New South Wales and Queensland have gained $1.37 billion in additional income and produced 226,000 tonnes more of canola than would otherwise have been produced if conventional seeds had been used. GM traits in cotton and canola have also contributed to a significant reduction in the environmental impact associated with insecticide and herbicide use on the areas devoted to these GM crops in Australia.

While we accept that many consumers do not currently accept genetically modified food and we respect their decision, the current restrictions and moratoriums on the use of genetic modified material in scientific research is restricting the potential to increase yield and tolerance to adverse conditions in our crop plants. Such restrictions have an impact on science investment decisions. In some cases, these considerations may slow or even prevent further research. The current moratorium in Tasmania severely restricts pure, fundamental research in institutes such as the Tasmanian Institute of Agriculture.

This is just a couple of examples. Australia has the scientific capacity and enthusiasm to seriously contribute towards achieving the aim of the NFF. But to do this, we need serious investment in research at both the fundamental and applied levels, and on-going support so that we can plan for the long-term and really make a huge contribution towards this ambitious goal of $100 billion by 2030, in an increasingly challenging environment.

The role of education in growing Australian agriculture

As reported by a recent ABARES report, data from the 2016 census indicated that people employed in the agriculture sector in Australia tended to have lower levels of education than those employed in other sectors of the economy. Importantly, only 10% of the agriculture workforce holds a Bachelor Degree qualification compared to 22% of employees in other sectors. In addition, 55% of people employed in the agricultural sector have no formal school qualification.

It is widely acknowledged that the agricultural sector is changing. Big data and precise technologies are playing increasingly important roles in the sector, allowing primary producers to remain competitive in the national and global market. These changes require deep knowledge and understanding not only of the fundamental science of plant and animal production systems but also of digital technology and information technology. There is a significant need for the agricultural workforce to become highly skilled and educated. Currently there is a skills shortage in the sector, with at least five jobs for every graduate from Bachelor of Agricultural Science degree programs.

University funding is based on enrolments. Enrolments in agricultural degrees have been suffering continual decline in recent years, dropping from 4300 in 2001 to less than 2300 in 2014, and with the existing funding model, this puts agricultural degree programs under threat. This has led to the rationalisation of many agricultural degree programs and loss of specialised academic staff. In 2014 there were over 4000 agricultural jobs advertised in state and national newspapers. With only 2300 graduates, there appears to be significant scope for attracting new students to agricultural sciences education but only if sufficient funding exists for the maintenance and growth of existing and future programmes of study. The National Farmers Federation (NFF) has stated that greater investment in agricultural education from primary to tertiary level is imperative for the longevity and growth of the sector. We concur with this sentiment that in an increasingly challenging climate (financially and environmentally), increased funding in agricultural education is essential if Australian agriculture is to grow to be worth $100 billion by 2030. Additional funding may come directly from the government but may also take the form of government supported industry collaboration between schools, university and key industry partners.

Yours,

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