PGG Wrightson Seeds - Submission to the Productivity Commission's Inquiry into Australia's Intellectual Property Arrangements.

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1. Structure of the pasture seed industry

Pastures form the base of Australia's sheep, cattle and dairy industries, thus their rate of improvement is of considerable consequence to the economic health of rural Australia. Historically state government departments and commonwealth research institutes (i.e. CSIRO) had a mandate and the resources required to improve pasture products. However, the last couple of decades have seen significant withdrawal of state resources to the point where there is little functional forage breeding capacity remaining in the public sector.

The reduction in state spending on pasture variety/cultivar improvement is largely driven by a 'beneficiary pays' principal and a realisation that state investment crowds out private sector investment. The most recent example of this withdrawal is this year's attempt to transition to private industry the West Australian state pasture breeding program, which is to be transitioned by tender process. The West Australian government has acknowledged the state breeding program was financially unviable due to Western Australian farmer's entrenched disregard for, and unenforceability of Plant Breeders Rights (PBRs) (Fulwood 2015). In Western Australia the illegal sale of PBRs protected cultivars over-the-fence is ubiquitous, and thus private (and shortly state) investment in the improvement of cultivars for Western Australian farmers is near non-existent. Thus the unenforceability of PBRs in Western Australia has likely deprived its farmers of investment required to improve their productivity.

In contrast, other pasture seed markets receive considerable private sector investment. The largest investment by far is focused on the breeding of perennial ryegrass, as this is sold primarily into markets which appreciate and seek to purchase products with improved economic traits. Perennial ryegrass improvement is further discussed below in relation to the questions posed regarding PBRs in the Productivity Commissions Issues paper.

Currently the Australian seed industry is comprised of approximately seven seed companies, three of which (all based in New Zealand) have consequential investments in research and development (R&D) with between three and twelve full time plant breeding staff in addition to support staff, and up to $15 million of annual R&D investment. Genetic gain in grass products is largely a consequence of investment by these large R&D firms. The 'breeding' activities of remaining firms is usually limited to the activities of a single person within the firm whose role is largely to generate crosses between elite cultivars (bred by the R&D firms) and select for sufficient morphological differences to gain PBRs registration. The morphological differences selected for are often of little or no economic consequence for farmers. Whilst it is yet to be tested, many cultivars marketed by these non R&D firms will have received little more than cosmetic breeding to circumvent the intent of PBRs legislation and thus likely fall within the bounds of Essential Derivation under the PBRs legislation.

In addition to local innovation, the licensing of IP generated overseas (in the form of cultivars) is the primary means of increasing product quality on the local market place in some species, for instance Lucerne.

2. Nature of innovation in pasture seed

Most species used in pastures are outcrossing (i.e. ryegrass, tall fescue, lucerne, phalaris and cocksfoot), where the marketed cultivar consists of heterogeneous populations exhibiting relatively uniform morphological traits. This is in contrast to cereals and many fruits and vegetables and ornamental plants where products marketed are either homogeneous populations (for self-pollinating species) or are vegetatively propagated. The innovations of economic relevance to farmers are primarily forage yield, forage quality and persistence and disease resistance of the forage plants. In contrast, PBR only concerns itself with morphological traits, the majority of which are usually of no economic consequence to a farmer.

The most critical innovations for pasture based farmers are those of highest economic importance, including:

- increased forage production in seasons of feed shortage, i.e. autumn, winter and summer;
- the ability for a plant to persist, thus reducing the average annual cost of pasture establishment;
- the digestibility and chemical characteristics of the forage grown; and
- resistance of the forage plant to relevant diseases.

Given all of the above can be readily measured, if innovation in them is to be encouraged we must seek to make the IP associated with their improvement protectable, currently it is not.

3. What limits the rate of innovation in pasture seed products?

With the withdrawal of state breeding resources, investment in the improvement of pasture seed products is now entirely a function of a private firms expected return. There are three pre-requisites conditions for a firm to realise a return on investment in pasture seed products. These are listed and discussed below.

3.1. Demand

There must be sufficient demand from farmers for a particular products/solution. Firms will invest the most resources into the markets with the highest potential returns given existing IP rights. An example of this is the large investment into perennial ryegrass but the comparatively small investment into the improvement of products for Australian farmers in marginal farming zones. Intellectual property rights have a role in demand as they allow product differentiation, a prerequisite for the communication of product quality.

3.2. Information transparency

There must be market place transparency, i.e. no product quality information market failure. Currently all firms in the Australian market place, including those with no consequential R&D investment claim to have the best products for Australian farmers. This is not possible, and as there is no independent arbiter of product quality, the Australian market place is rife which what likely qualifies as deceptive and misleading conduct. This inability to transparently communicate product quality significantly constrains the private sectors ability to invest in innovation for Australian farmers. It is promising to see farmer levy funded organistions such as Meat and Livestock Australia (MLA) and Dairy Australia (DA) finally appreciate the role this information market failure has in constraining investment. Both organistions are attempting to solve it via establishing transparent cultivar evaluation schemes.

Intellectual property rights like PBRs are essential for these in-market product quality testing programs as they are needed to justify the investment in such programs.

3.3. Intellectual property rights

There must be sufficient IP rights to prevent free-riding and allow a return on investment for the IP generator. This is discussed in the sections below.

4. Productivity commission questions regarding the efficacy of plant breeders rights

Questions 1 - Is there quantitative evidence to show that the introduction of PBRs led to an increase in the quality and quantity of new plant varieties, and as increase in the role of the private sector in plant breeding?

As an important input to most Australian dairy farms and many Australian sheep and beef farms, perennial ryegrass is by far the highest value market segment (by seed sales) within the Australian pasture seed market. Prior to the introduction of PBRs no private firm bred perennial ryegrass as it was not possible to obtain a return on investment. After the introduction of PBRs many firms commenced perennial ryegrass breeding and the improvement of these products now attracts considerable investment.

PGG Wrightson Seeds have a large database of perennial ryegrass cultivar performance data, with information on almost all cultivars currently and historically marketed in Australia and New Zealand. Total annual dry matter production is one important measure of a cultivar's performance and in Figure 1 is shown as a function of year of release. Cultivars bred by the state sector are displayed in red and private sector cultivars displayed in blue.

Figure 1 has been provided commercially-in-confidence to the productivity commission.

Figure 1 Rate of genetic gain in total annual yield

Impact of PBRs on quantity of available plant varieties.

It is clear that prior to the introduction of the Plant Variety Rights Act of 1987 there was no private sector investment in perennial ryegrass breeding. Subsequent to the introduction IP legislation the private sector commenced significant breeding efforts. Plant Breeders Rights have afforded firms sufficient IP protection to incentivise some investment in perennial ryegrass breeding and this has undoubtedly had a positive impact on the quantity of new plant varieties available to Australian farmers.

Impact of PBRs on the quality of available plant varieties.

Linear regression equations fitted over both the state and private bred product reveal the introduction of PBRs has also had a very positive impact on the rate of innovation. Historically state bred products increased in yield at a rate of 11 kg of dry matter per hectare per year (kgDM/ha/year), whilst those released by private firms increased at a rate of 66 kgDM/ha/year, six times the rate of gain. This data clearly demonstrates the positive impact PBRs have had on the quality of new perennial ryegrass variety available to Australian farmers.

Figure 1 also demonstrates that as a consequence of information market failure, many firms are able to market products to farmers that are in no way improved in yield, i.e. private products below the regression line. It is hoped that MLA and DA's market place transparency measures limit the opportunities for this regrettable behavior by some seed companies.

Question 2 - The Commission seeks evidence from plant breeders and other stakeholders (particularly farmers and farm representatives) on whether the introductions of PBRs has led to a more productive and profitable agriculture sector in Australia that would have been the case under general IP protections.

It is clear from Figure 1 that the introduction of PBRs is strongly associated with a large increase in the number and performance (six times greater annual rate of improvement) of plant varieties available to Australian farmers, and as such will have contributed to a more profitable agriculture sector in Australia.

An independent review by Dairy New Zealand (2011) indicates the genetic gain realised by private sector firms has increased annual profits of New Zealand dairy farms by approximately $20/ha/year. We would expect a similar conclusion had the work focused on Australian data.

It is more difficult to determine if a similar rate of gain could have been achieved under more general IP protections such as patents. Given patent protection existed prior to the introduction of PBRs and yet there was no private sector perennial ryegrass forage breeding, history suggests the investment in plant breeding would be much lower under more general IP protections.

Question 3 - Are the protections afforded under PBRs proportional to the efforts of the breeders?

Breeders of pasture products seek to improve traits of economic relevance to farmers including seasonal yield, forage quality, persistence and disease resistance, whilst PBRs is largely concerned with morphological traits, most of which are economically inconsequential for the financial wellbeing of farmers. The process required from inception of an idea to first sale of seeds takes approximately 15 years and is demonstrated in Figure 2 below.

Figure2 Timeline for breeding an innovative product

As R&D focused firms such as ourselves are also involved in pre-breeding (steps required prior to the breeding process, i.e. germplasm collection and the development of novel biotechnology approaches), some products have a further 10 years of expenditure proceeding the process described above.

As discussed earlier, despite PBRs legislation intending to spur innovation by allowing a breeder to benefit from their innovation and prevent free-riding, in reality, due to reasons of enforceability, and PBRs focusing on economically inconsequential morphological traits, innovations in the aforementioned traits in out-crossing species remain essentially non-rivalrous and non-excludable goods. Whilst it takes the financing of a team of skilled professions many years to improve the performance of economic traits, it takes relatively little time and minimal expenditure to 'free-ride' by altering morphological traits.

To demonstrate this point we have analysed a recent PBRs application which describes the 'breeding' of a new phalaris cultivar. As a background, the first phalaris' in Australia had poor winter growth and were sensitive to acid soils. Much investment by the CSIRO using a range of plant breeding techniques improved the winter growth rates, acid tolerance and persistence of various

cultivars. In the 'Origin and Breeding' section of this PBRs application it is described how a number of cultivars (all bred and owned by the CSIRO) are crossed, with seed from one of the cultivars being collected and subsequently planted with offspring selected for morphological traits sufficiently different to allow PBRs registration. It is doubtful the process described in this particular PBRs application has any consequential positive impact on traits of economic relevance or is in any way innovative or creative. As such this PBRs application literally describes the series of steps required in an outcrossing forage species to circumvent the intent of PBRs legislation. In this instance CSIRO have certainly not been afforded protections proportional to their efforts. Many PBRs applications for outcrossing forage species from firms lacking consequential R&D spend describe a similar process. In contrast to the process required to improve a products value to society via innovation, the process of 'free-riding' as it occurs in our industry is described below in Figure 3.

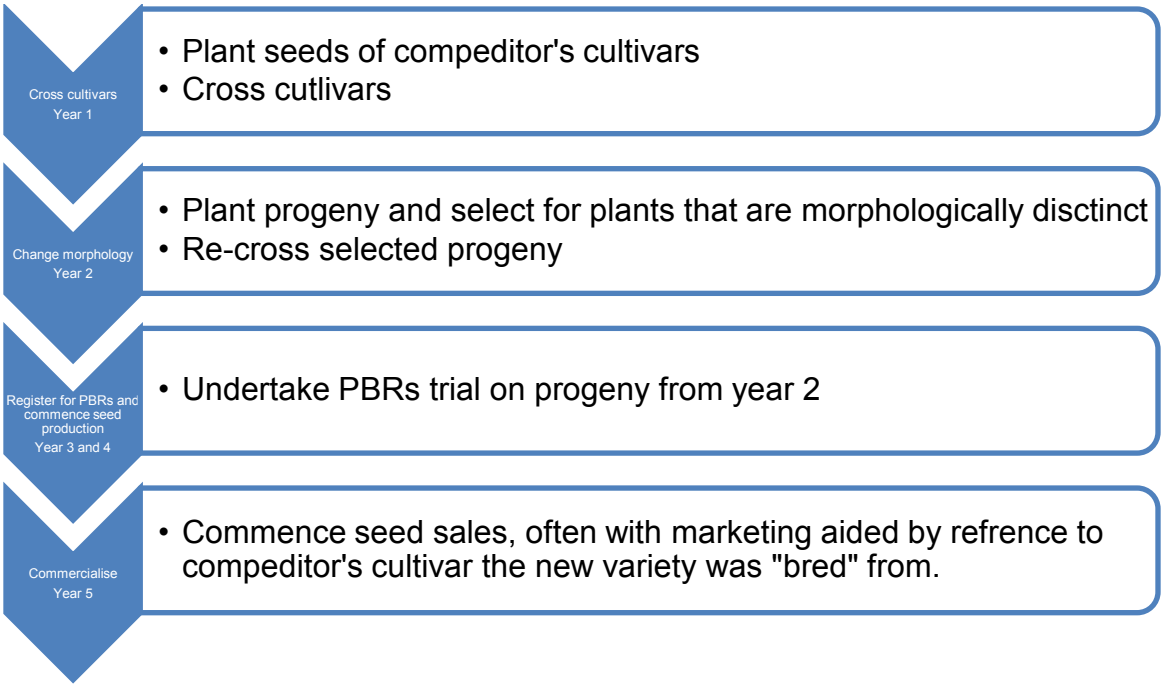

Figure 3 Timeline for 'free-riding'

The process above describes what is required to free-load within the PBRs system. However, as PBRs legislation does not apply to cultivars not registered for PBRs, a far quicker way to circumvent the intent of PBRs legislation is simply to market a competitors cultivar with a different name or an in-paddock cross between competitor cultivars (where two competitor's products are mixed, sown in a paddock and the resulting seed harvested). Thus pasture seed companies can be profitably run by free-riding a large portion of their IP directly off R&D focused companies. This process is common, and should the commission require it we are able to highlight many cases of this occurring in many important pasture species.

Given the protections afforded under PBRs for outcrossing forage species are minimal, we suggest the legislation does not offer reward proportion with the breeder's effort. Whilst the lack of any effective intellectual property rights may only impede genetic gain in species such as perennial ryegrass for which there are many comparatively informed consumers, for species with smaller

market sizes (like the species cocksfoot and phalaris, both important for Australian farmers) where information market failure is rife (i.e. firms can easily mislead the market about product performance), minimal private sector breeding occurs, if any.

An additional issue for the pasture seed industry and one we believe the Australian Seed Federation (ASF) have addressed in their submission to the commission is the over the fence trading. This practice is rife in areas such as West Australia, and common in Tasmania. This practice (especially in Western Australia) seriously diminishes Seed Company's ability to invest in product improvement for these markets.

Question4 – Is there evidence the introduction of PBRs has contributed to the development of the Australian seed export industry? Is this a suitable role for IP policy?

Australia has a healthy and growth seed export industry that is no doubt aided by the existence of PBRs in Australia. Whilst many overseas markets are generally indifferent to cultivar (i.e. they just want Lucerne seed and are not concerned with the cultivar), some markets (for instance perennial ryegrass into Europe) require PBRs registration as part of a broader quality control process. As such PBRs does contribute to the Australian seed export industry.

Question 5 - How adaptable is the system of PBRs to technological change? Should PBR legislation be amended in light of technological developments, or can new high-value plant varieties (however they are developed) be adequately supported by patent laws?

Molecular plant breeders no doubts have concerns about the PBRs system. The act of improving traits of economic importance via molecular techniques does not necessarily alter morphology. As such a cultivar with an economic trait improved via marker assisted selection (MAS) or genomic selection (GS) may be un-protectable, as it is morphologically indifferent from other cultivars. Even if it were to be grated PBRs (presumably due to breeding for an inconsequential morphological trait), the genetic gain would remain non-rivalrous and non-excludable, reducing incentive to use the molecular plant breeding techniques.

Molecular plant breeding techniques are substitutes for traditional plant breeding techniques and as such the deficiencies associated with the PBRs system are common to plants bred via either of these. Given the relatively recent emergence and rapid progression of molecular and DNA based technologies capable of determining the relatedness of plant populations, the ability to utilise DNA technology to inform PBRs decisions and aid enforcement must be considered a high priority. Whilst the system continues to rely of morphological traits to decide on the distinctness of cultivars, PBRs will remain almost impossible to defend, and thus ineffective in outcrossing species.

5. Principals to guide the assessment of the IP system as they relate to innovation in pasture breeding.

Below we consider in turn each of the principles by which the Productivity Commission propose to review the PBRs system, prior to making recommendations.

5.1. Efficacy

Despite problems with enforcement (i.e. over-the-fence trading), the PBRs system is more effective for self-pollinated species (i.e. cereals) and vegetatively propagated crops (i.e. potatoes) than cross pollinated species. Even when over-the-fence trading occurs in broad acre crops that deprive the IP owner of seed sale revenue, the end point royalty system for cereals appears to provide sufficient revenue to warrant breeding effort. The same cannot be said for forage products where free-riding by other seed companies or over-the-fence trading deprives the breeder of all return on investment.

Existing IP rights are somewhat effective, as in some product categories, such as perennial ryegrass, it allows innovation to occur which we and our data set's suggest would not have occurred in the absence of these rights. However, in other categories they must be considered ineffective, as they are insufficient to spur any consequential private investment.

Additionally the existing IP rights aid trade in and dissemination of innovations through the economy by allowing a market place with differentiated products to exist.

Does the IP system lead to additional IP being generated?

The protection afforded by PBRs has resulted in effective private sector investment in some pasture species. The example given above is of perennial ryegrass, where the private sectors involvement is correlated with six times the rate of genetic gain that occurred under state programmes. However, there are many more species of arguably equal importance to the Australian economy (i.e. sub-clover and phalaris) that are ignored for very good financial reason by private sector breeders. Future rates of genetic gain in these species relies on solving information market failure, in addition to providing sufficient IP protection to afford firms a commercial return on their breeding investment.

Is the IP system effective in dissemination IP?

The IP system for plant varieties has undoubtedly aided the trade and dissemination of IP. Whilst there are many exceptions, the existing system of IP rights has allowed firms to increase investment in some species and trade these domestically and internationally. In addition, the existence of IP for plant varieties in Australia has allowed Australian farmers to benefit from the licensing of plant varieties bred overseas.

5.2. Efficiency

Is the IP system getting the right balance between encouraging IP creation and costs that rights cause?

As we have described above, in relation to pasture species, the current IP system infers little if any costs as it is largely not enforceable, i.e. over-the-fence trading in Western Australia and Tasmania and circumventing the intent of PBRs is easily completed with only minor plant breeding efforts. As such we would suggest the balance as it stands for pasture species is not optimised and does not maximise the wellbeing of Australians.

Is the IP system ensuring IP is being generated at the lowest cost?

As a consequence of the limited protection the current PBRs system provides for outcrossing forage species, firms will seek alternative ways to protect their investment in plant breeding. In the long run these will likely include tightly held and contractually enforced trade secrets and patent protection, we as a firm are beginning to explore both these options. It is doubtful the plant breeding processes required to achieve the above are the lowest cost means of generating genetic gain, but they become a commercial necessity when other options to protect IP are not available.

Further, as the number of varieties of common knowledge increases, so too does the challenge of breeding cultivars that are morphologically distinct, and thus able to be protected. In response to this, firms are diverting ever increasing breeding resources away from traits of economic importance and into breeding for trivial morphological differences. From society's perspective, this is a complete waste of resources as it ultimately detracts from the quality of product offered to farmers.

Is the IP system ensuring that IP is traded so that those that can use it most efficiently can do so?

The existing IP system allows the trading and licensing of our property rights to others. In addition, many of the products in our portfolio are purchased or licensed from other firms both local and international. Given this, we suggest the system does allow the trade of IP and market forces tend to ensure it is traded to those who can most effectively utilise it in any given market.

Is the IP system appropriately balancing the long-run costs and benefits that stem from the system's effects on competition and innovation?

In many important product categories for Australian farmers the existing system of IP rights fails to incentivize any private sector research and development, and consequently little innovation occurs in these product categories.

In a limited number of categories, some innovation occurs as a consequence of the limited property rights currently offered but we feel in the long long-run, the benefit to Australian farmers could be enhanced by allowing firms greater return on investment by preventing free-riding. We must note however that the industry is rife with deceptive and misleading conduct, and unless this is also eliminated via transparent cultivar evaluation schemes, additional property rights on their own may not result in better outcomes for Australian farmers.

5.3. Adaptability

Does the IP system adapt as the nature of innovation, competition and broader economic conditions changes?

As it stands the existing IP system for plants is blunt, ineffective and un-adaptive. The most recent consequence of the system's deficiencies is the cessation of all Western Australian state forage plant breeding efforts. One of the main contributors to the states decisions to withdraw from breeding efforts was an inability to capture all due royalty streams. This was caused by large amounts of illegal over-the-fence trading (Fulwood 2015).

The future will see significant challenges placed on agricultural system and the private sector is well positioned to solve these problems on behalf of Australia, as its successful track record in perennial ryegrass demonstrates. However the private sector will not contribute to its full potential whilst it cannot gain viable returns. Our IP system must adapt if we are maximise the wellbeing of rural Australians that now rely on the innovative potential of private firms for their productivity gains.

5.4. Accountability

Are the policies and changes made to the IP system evidence-based and transparent?

In 2007 and Australian Seed Federation made a submission to the Australian Council of Intellectual Property (ACIP) review into the enforcement of plant breeders rights. In 2010 the ACIP report was published and as yet few of the accepted recommendations have been implemented. As such the IP system does not appear to be responding to considered evidence.

Examples of recommendations important for the pasture seed industry from the 2010 ACIP review of PBRs are:

- Recommendations 8 – "Enable EDV declarations to be made in respect to any variety";
- Recommendation 9 – "Amend s.4(c) by replacing the test for important features with a test for essential characteristics"; and
- Various recommendations which aim to make enforcement of PBRs rights feasible.

The outcomes from the ACIP review should be revised and implemented.

6. Recommendations and conclusion

Based on our submission above to the Productivity Commission's issues paper on intellectual property arrangements, PGG Wrightson Seeds make the following recommendations. All recommendations are made in the belief they are prerequisites for the innovation required to improve forage products upon which the profitability of Australian grazing industries rely.

Recommendation 1: **The PBRs system should make innovations of economic consequence protectable, instead of differentiating products based on easily measured and altered morphological traits of negligible economic consequence. The traits of primary economic consequence for the Australian livestock industry are: seasonal yield, persistence, forage quality and disease resistance and should all be considered for IP protection.**

Rational for recommendation: In previous sections we have described in detail how the system of free-riding functions in the pasture seed industry. We believe this is the primary constraint (in addition to information market failure) on economic returns to plant breeders and thus rates of genetic gain.

How the recommendations might be implemented: We recommend an expert panel be formed to fully review the drivers of innovation in our sector based on historical evidence. This will require consultation with industry. In light of this, and a better understanding of the extent and consequences of 'free-riding' and other infringements of IP rights, the panel should form recommendations that better balance the IP protections afforded the pasture seed industry. We have a variety of suggestions about how this might be achieved, but a further review is the appropriate forum for them.

Recommendation 2: **The PBRs system should seek to allow molecular/DNA based techniques for determination of distinctness.**

Rational for recommendation: The protection of IP rights in out-crossing species is virtually impossible to defend based on morphological features. The acceptance of DNA based techniques would reduce the costs associated with protecting IP rights.

How the recommendation might be implemented*:* Again we recommend an expert panel be established to review how molecular techniques may aid in the registration of cultivars for PBRs and the enforcement of PBRs. Of course Recommendation 1 and Recommendation 2 are interdependent on each other, i.e. there is little point changing the focus of PBRs if they remain virtually impossible to enforce and defend and there is little point adding molecular tools to the options for PBRs defense if the PBRs is of little worth, as is currently the case.

Recommendation 3: **The IP rights granted under PBRs should extend to non-PBRs cultivars and those essentially derived from them.**

Rational for recommendation*:* This addition to the act is essential for proper functioning of recommendation 1 and 2, and is well warranted given the portion of non R&D firms portfolio's that consist of varieties not registered for PBRs. It is also vital for the prevention of over-the-fence sales.

Recommendation 4: **PBRs for forage varieties should be extended to 25 years.**

Rational for recommendations*:* Forage cultivars, especially those for low input marginal farming areas have very slow adoption, in many cases a cultivar has been marketed for 10 to 15 years before producers gain the trust required in a variety to utilise it on their farm. Given this lag in adoption, no sooner is a cultivar reaching its commercial potential required to return an investment to the breeder than current PBRs expires and returns cease. Given the private sector will be called upon to solve many of the big challenges faced by Australian farmers, extending PBRs for forage cultivar to 25 years is essential to ensure investment in the high risk, low return research required.

Recommendation 5: **We also support the recommendations offered by the Australian Seed Federation, in their 2007 submission to the ACIP. These are critical to improving the enforceability of PBRs.**

We are yet to see the IP system adapt to the realities of the current market place of reduced state investment and ever bolder disregard for intellectual property rights. We hope this review and that changes that come from it allow the full and necessary potential of private led innovation to be realised for the benefit of Australian farmers.

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