UNLOCKING THE POTENTIAL OF THE COW

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Overview

The intent of this paper is to identify and exploit the opportunities provided by the investment of the dairy industry in high quality genetics and to take better advantage of the Australian production environment to unlock the potential of the cow and our industry. The body of work reported is associated with the Dairy UP initiative but also with other studies and implementation of the research on farm being conducted by Scibus, an independent consultancy and research company.

Figure 1 (Schuster et al.,2020) shows that Australian milk production per cow has not matched that of many other countries for several decades. Given that milk production per head is less than that of many countries more than 20 years ago, the investment in genetic selection for higher production has not returned yet returned investment to Australian producers. Simply, genetic merit for production will not be expressed unless the nutrients and environment required for production are also made available.

In this report we highlight many of the potential paths to unlock the potential of the cow that we have worked on – these can be adopted with confidence – and identify where to head in the future to continue progress. We also note the huge potential to continue to develop the pasture/ forage base as this is also essential to progress.

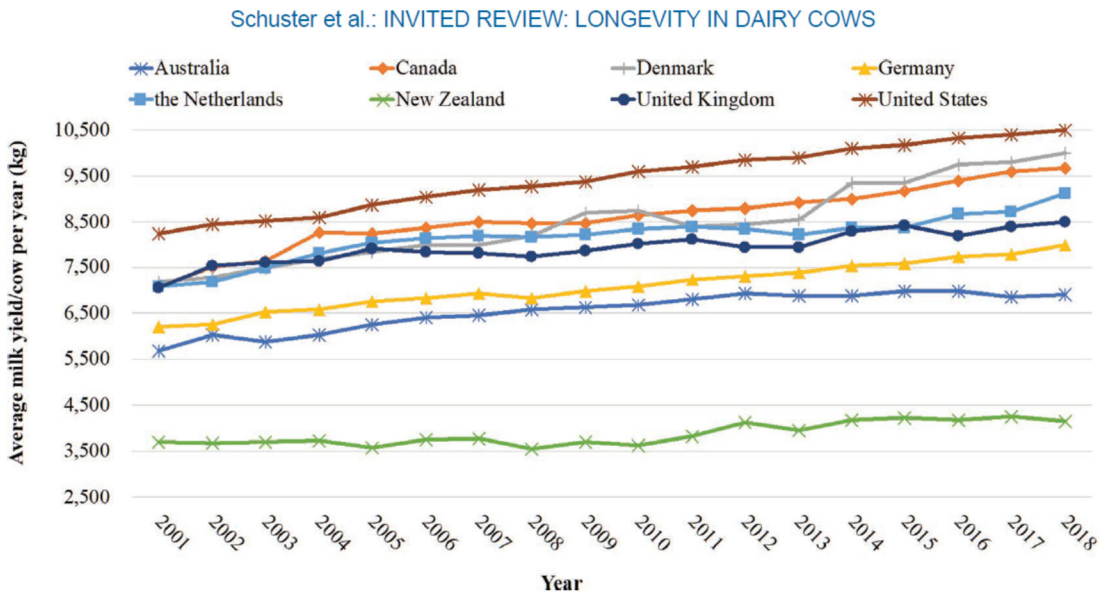

Figure 1. Average milk production per cow per year for different developed countries (from Schuster et al., 2020).

Providing environments to unlock the potential of the cow

Optimising cow potential can be achieved with additional feed, better quality feed or by a reduction in maintenance. Other strategies that can help achieve this are to improve efficiency of production through improved health and increased productive life of cows. The following activities are directed towards allowing those strategies to be realized.

1) Academic publications to support potential to achieve high production with an existing herd: (Westwood et al., 2000; 2002).

2) On farm demonstration (Scibus): Moving cattle into facilities that allow them to receive optimum nutrition, reduce unecessary exercise and reduce impacts of climate on milk production, will achieve the most rapid increase in milk production and has been successful. Egs

- Camden farm – covered feedpad 2001 (Cows ~ 9000 L to >14000L (305 d basis);
- NSW. 2001 Farm move from coast to inland 9000 L to >12,500, (305 d basis)
- South Australia. 2005 open lot to covered feedpad to 2015 loafing barn with bedded pack 6000 L to > 13,000 L, (305 d basis)
- Victoria. 2019 open feedpad and graze ~ 8000 L to >12,500 (305 d basis), The herd increased within 3 weeks by 6L per head).

Conclusion: These and other Australian herds have taken advantage of facility design to increase the efficiency of milk production. The opportunity to do this will be appropriate for many farms. Others may be better to stay with a pasture-based system for some time. Pasture based systems can also sustainably intensify by improving infrastructure, nutrition and management and the effectiveness of their feedbase

What next: Ongoing work will determine improved efficiency, cost effectiveness and move more of industry to optimal production strategies. Current studies include i) impacts of diet and weather on milk production, milk components, pregnancy and health. ii) improving bedded pack barns – a) ventillation, b) design, c) microbial interventions as well as working with clients, sponsors and engineers to improve facility design.

Increasing the length of productive/ profitable life of the cow

Figure 2. shows the age structure for a Dairy UP study with 36,000 head of cattle. A small shift in age structure to retain more cows through to their peak production potential would allow for ~16% additional milk production (Figure 2). Why are farmers removing these cows early? The main reasons are that cows are removing themselves from the herd mainly because of reproductive failure and increased risk of disease with age (Figures 3 and 4).

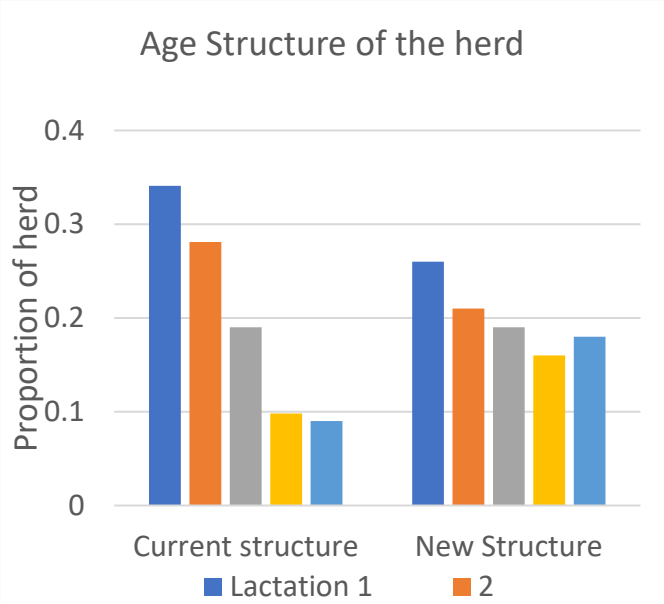

Figure 2. Existing herd age structure and a new herd age model to increase milk production by 16%.

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What have we done to date: We published 2 papers (Lean et al., 2022 ab) that identify the major causes of removal by parity. We have summarized the vast amount of work on how improve health, reproductive performance and production through better Transition Cow Management (Lean and DeGaris 2021). Well designed transition diets markedly improve health and increase production.

We have identified reproductive interventions that work (Lean and Morgan GnRH for repeat breeders increases probability of pregnancy by 24% (Lean et al 2009); Bisinotto et al., 2015 using progesterone insertions to increase pregnancy to AI in synchrony programs) and used these on farm. We have also identified which feeds influence fertility (Lean and Rabiee 2007; Rodney et al., 2018). Importantly

feeding fats can markedly improve fertility of cows (Rodney et al., 2015) as do well designed diets to provide metabolisable protein but keep soluble protein to target (Westwood et al., 2002; Lean et al., 2012).

We are working on modelling GHG emissions from Australian farms with a view to ensuring that models describe enteric emissions (approximately 45% of total emissions) to provide useful calculations for CHG reporting for the industry in the future.

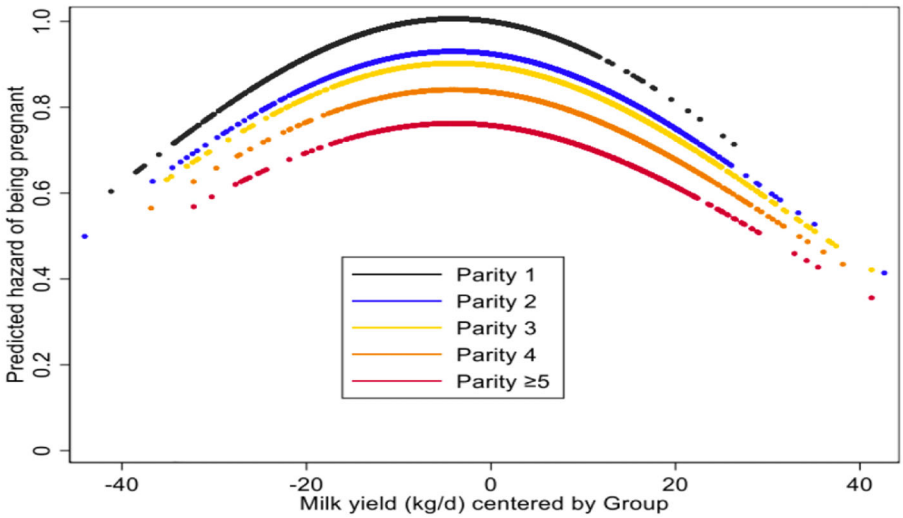

Figure 3. Probability of getting pregnant in a lactation by parity and milk production within a herd.

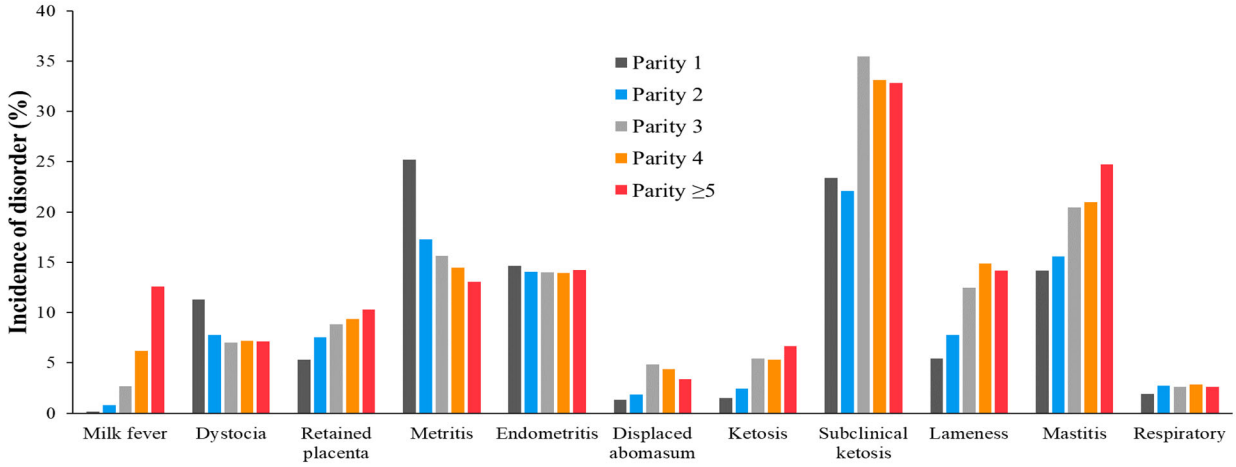

Figure 4. Incidence of disorder by parity in 36000 cows in Australia, USA and Canada

When considering health impacts in the dairy herd, work lead by Dr Helen Golder has identified the key risks leading to ruminal acidosis – a condition that poses major risk for Australian cattle with more than 10% of cows experiencing this at a time (Bramely et al., 2008; Golder et al., (2023). The effective use of rumen modifiers can control this risk within the herd (Golder et al., 2014; 2023).

Improving the health and productivity of the cow: Current work – future work David Sheedy, Helen Golder and Andrew Lean are developing adatabase of all production data from 15 intensive and 15

extensive farms. This database will contain >100,000 high quality cow records to further investigate the reasons for removal of cows. It is anticipated that key reasons for loss me be to do with metabolic disease. Older cows gain weight, but lose body condition score (BCS) (Lean et al., 2022c) which places them at potential risk of metabolic disease due to the high energy bruden with increased parity.

The reasons for loss of body condition in older cows, despite intensive management, is not known. David Sheedy has collected data from nearly 2000 cows has obtained critical information on the causes of reduced BCS and the relationship between this and loss of cows from the herd. As we understand, more deeply, causes of loss and differences between production systems, we can change diet and environment, and genetic selection to improve cow outcomes and prevent loss of condition leading to loss of cows from the herd. Maddi Pearce is working to identify early alerts for disease based on behavoural change in a University of Sydney/ Scibus project to address some of these health-related indicators of poor performance.

To determine the impacts of early joining, and therefore increased longevity on cow production, Andrew Lean and the team at Charles Sturt University are enrolling heifers based on achieving critical mating weight to allow these to calve as early as 20 months of age. It is anticipated that, in addition to reducing the green house gas (**GHG**) and other costs in rearing by 15% or more through early entry of cows into the milking herd, there may be greater lifetime productivity and profit through early heifer management. The net present value of the heifers should increase and there are less heifers to rear as replacements – this would be further reduced with increased length of productive life - providing numerous opportunities for profit.

Desirable outcomes: Understanding the structual risks for removal and how they differ in different production systems to provide social licence for all types of dairy production. Identify how to feed and manage cows for greater length of productive/ profitable life and reduce environmental impacts.

Conclusion: If we can get better length of productive life and calve younger heifers, we can forsee marked improvements in profit and reductions in overall GHG production and markedly reduced intensity of GHG.

Improving the health of the calf

PhD student Sarah Legge is looking at the impacts of early life rearing on later production, while Barbara Brito-Rodriguez has sampled more than 30 calves per farm from 72 farms across the State in a world-leading project to evaluate the normal and abnormal gut and respiratory infectome of dairy calves. Already, she and co-workers (Brito Rodriguez et al., 2023 abc) have detected bacteria, virus and protozoa that have not been previously considered or detected that may play significant roles in disease. As we understand the normal and abnormal environment, we will develop new strategies to improve calf health. Critically, Barbara has also conducted a survey of the rearing practices on the farms that will be linked to the disease conditions and organisms there. Scibus is working on change in the ruminal microbiome in early calfhood with a view to developing better health and production.

Early Disease Detection

Changes on the farm mean that farm management has less time to engage with the individual cow. These changes influence the delivery of veterinary services as the individual cow now represents a much lower proportion of the enterprise asset value. However, herd health and productivity are critical to an

enterprise and farmers are committed to stewardship of their cattle. They need management interventions that are a) timely, and b) have a high chance of success. Producers need early alerts for the diseases, particularly where those conditions can devastate the herd and cause insidious loss of production and profit. To address this unmet need, we have been working with NSW DPI to provide rapid alerts for farmers to the presence of diseases for which early intervention is critical for optimal performance outcomes, for example '3-day sickness' or high spore counts as a causal indicator of outbreaks of facial eczema.

What have we done: We recently published 4 papers looking at how we can make better use of milk obtained for routine herd testing (ie daily pickup milk) and from herd recording to provide more active monitoring of farms. Bulk tank milk especially provides a readily available and contemporary indicator of herd status of health and production and, where appropriate, compare the value of bulk milk testing to that of individual cow testing, to determine the mastitis (Rowe et al., 2024), viral (Brito and Hick 2024) and metabolic status of herds (Lean and Golder 2024).

What next: We are actively working with DPI and University fo Sydney to tailor packages of tests that can be applied to bulk milk and milk from herd recording. We have started to reach out to dairy processors and herd recording agencies to get more value out of existing testing and to see whether there is some appetite to help pay for routine testing.

We sincerely hope that we can get the rapid alert system in place RAPIDLY!

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