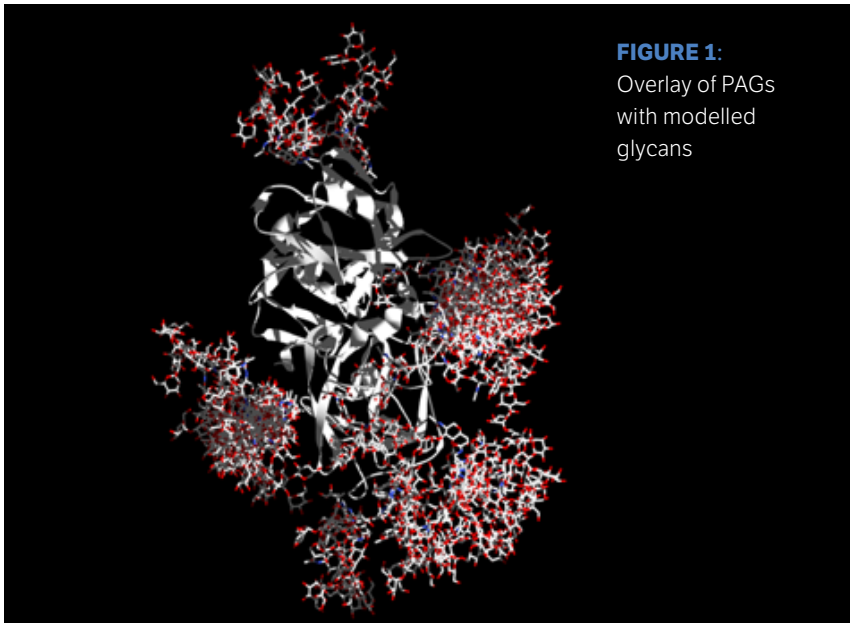

FIGURE 1: Overlay of PAGs with modelled glycans

Producing more with less: *the embryonic mortality question*

Identifying, managing and understanding embryonic loss in cattle is a key factor in helping farmers to run profitable beef and dairy cattle operations. Here, IDEXX Laboratories Senior Marketing Manager Worldwide (Bovine) **Jim Rhoades**, Medical Affairs Veterinarian IDEXX (NZ) **Andrew MacPherson**, Account Manager **Ian Burke** and General Manager (Commercial) IDEXX (NZ) **Carl Eden** discuss the causes, the costs and what New Zealand veterinarians could learn from practices used overseas.

THERE IS INCREASING attention and pressure on New Zealand farmers to produce more with less, while still complying with increasingly stringent animal welfare and environmental regulations. Farmers continue to use world-leading farming practices to achieve this, therefore any small productivity gain is important.

After factoring in the many and varied pressures, animal fertility remains the cornerstone of profitable dairy and beef farming operations. However, fertility can be negatively affected by multiple factors (eg, nutrition, infectious disease, and management), so being able to routinely get cattle pregnant and have those pregnancies carry through to calving is very important to a profitable farming operation. Significant to this is being able to determine accurately if a cow is pregnant or, of equal importance, being able to identify cows who are not pregnant. In recent years, minimally invasive methods have been developed and refined to enable veterinarians and their clients to make timely and cost-effective strategic reproductive and management decisions.

Embryonic loss is considered one of the greatest economic challenges for dairy and beef farmers. Among US beef producers alone, the annual losses routinely exceed US$1.2 billion (Geary, 2005). When you consider that there are 10.1 million cattle in New Zealand (6.5 million dairy cattle), what could the cost look like for New Zealand farmers?

Fertilisation rates in both natural service and artificial insemination (AI) are generally recognised as being between 90% and 100%, with rarely more than 70% of breedings resulting in positive pregnancy diagnoses 30 days later (Geary, 2005). Pregnancy loss between fertilisation and day 42 of gestation is defined as an embryonic loss, with losses occurring on day 43 and after described as fetal losses. Embryonic losses are further categorised as being early embryonic mortality (EEM), which occurs between fertilisation and day 27, and late embryonic mortality (LEM), which occurs between days 28 and 42.

The greater part of embryonic mortality occurs during EEM, with rates ranging from 20% to 44% (Humbolt, 2001), with an additional 3–14% of losses occurring during LEM. While it was once believed that the bovine conceptus was reabsorbed after an embryonic loss, transrectal ultrasound examination has demonstrated that the conceptus and its breakdown products are expelled through the cervix, which either goes unnoticed or appears as a vulvar discharge of clear mucus (Bajaj and Sharma, 2011).

IMAGERY: SUPPLIED

Identifying animals who have experienced embryonic loss soon after the event allows the animals to be re-bred, thus limiting the economic loss to the producer. Blood- or milk-based sample pregnancy testing has been shown to be reliable (Green et al., 2000) and convenient for the dairy or beef cattle farmer. The tests identify pregnancy-associated glycoproteins (PAGs) that are only produced when the cow is pregnant. Commercial tests are currently available that can be used as early as 28 days post-breeding. Pregnant cows do require additional confirmatory testing throughout gestation, as pregnancy loss may occur but at a lower rate as the pregnancy progresses (LeBlanc, 2013). Cows identified as not pregnant or in the re-check zone should be selected for further investigation. This might be a veterinary exam or a follow-up sample for PAGs testing a week or two later. Identifying these empty cows and managing them based on individual needs is an important part of a farm's strategic reproductive management programme and the overall success of the operation.

FACTORS AFFECTING LOSS

Genetic abnormalities make up about 10% of the embryonic losses, and have been found to occur within the first two weeks of pregnancy (Geary, 2005). These abnormalities can also cause fetal mortality in the later stages of gestation.

Nutritional factors play an important role in pregnancy, with higher pregnancy rates reported in cows gaining weight during conception (Wiltbank et al., 1962). Additionally, a number of toxins found in mouldy feed have been shown to decrease pregnancy rates (Geary, 2005).

Heat stress, especially in the days immediately following breeding, contributes to higher rates of pregnancy loss (Geary, 2005). Transportation stress has also been shown to increase pregnancy loss, with a study of heifers transported for six hours either 8–12 or 29–33 days after AI showing lower pregnancy rates than heifers who were transported one to four days after AI (Harrington et al., 1995).

Infectious agents such as bovine viral diarrhoea and *Neospora* infections are also well known to cause abortions or decreased fertility.

TABLE 1:

Approximate costs of carrying over an empty Kiwi cross-bred cow in a spring calving situation.

Lost production based on 340kg milk solids (MS) per cow @ $6.65/kg MS	**$2,261**
OTHER COSTS	
Grazing, 1 June to 31 May	**$520**
Animal health reasons for the cow being empty	**$65**
Mating cost	**$25**
Miscellaneous costs (eg, cartage, identification/ tagging, LIC MINDA records, etc)	**$45**
TOTAL COST	**$2,916**
Minus cull credit (based on 2019 autumn schedule)	**-$725**
NET COST	**$2,191**

ECONOMIC IMPACTS

Pregnancy tests performed during the 28- to 42-day post-breeding window have a 3–14% chance of being incorrect due to the risk of LEM or pregnancy loss. If a pregnancy is lost, every day counts in reestablishing a pregnancy and keeping a cow productive in the herd. To put a dollar value on what the cost might be for carrying over an empty cow, Table 1 shows some ballpark figures to consider. (Note, this is by no means an exhaustive list, as there may well be other costs that will affect the final figure.)

The estimated $2,191 cost of carrying over an empty cow is significant and will likely not be a big surprise to those in the industry. However, the ability to make informed management decisions about culling, selling for winter milking or retaining and milking a cow for longer can have significant and beneficial economic consequences for the farming operation. Being aware of the significance of embryonic mortality and having the ability to detect empty cows accurately so that informed management decisions can be made are vital. The ability to test for PAGs in either milk or blood has been increasingly adopted overseas, providing veterinarians with an additional method to increase the frequency of regular pregnancy diagnoses during pregnancy. VS

REFERENCES:

Bajaj NK, Sharma N. Endocrine causes of early embryonic death: An overview. *Current Research in Dairy Sciences* 3, 1–24, 2011

Geary T. Management strategies to reduce embryonic *loss. Proceedings of the Range Beef Cow Symposium XIX*. 2005

Green JA, Xie S, Quan X, Bao B, Gan X, Mathialagan N. Pregnancy associated glycoproteins exhibit spatially and temporally distinct expression patterns during pregnancy. *Biology of Reproduction* 62, 1624–32, 2000

Harrington T, King MR, Mihura HE, LeFever DG, Hill R, Odde KG. Effect of transportation time on pregnancy rates of synchronised yearling beef heifers. Colorado State University Beef Program Report. Fort Collins, Colorado, USA, 1995

Humbolt P. Use of pregnancy specific proteins and progesterone assays to monitor pregnancy and determine the timing, frequencies and sources of embryonic mortality in ruminants. *Theriogenology* 56,1417–33, 2001

LeBlanc SJ. Short communication: Field evaluation of a pregnancy confirmation test using milk samples in dairy cows. *Journal of Dairy Science* 96, 2345–8, 2013

Wiltbank JN, Rowden WW, Ingalls JE, Gregory KE, Koch RM. Effect of energy level on reproductive phenomena of mature Hereford cows. *Journal of Animal Science* 21, 219–25, 1962